Environmental Noise & Vibration Assessment

Crystal Creek Aggregate Expansion Project

Shasta County, California

BAC Job # 2022-093

Prepared For:

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Introduction

The acoustical consulting firm of Bollard Acoustical Consultants, Inc. (BAC) has been retained by Diaz Associates to assess noise and vibration impacts associated with the proposed Crystal Creek Aggregates (CCA) Expansion Project (project) in in Shasta County, California. The CCA location is shown on Figure 1. Figure 2 shows the Proposed CCA site plan.

Project Description

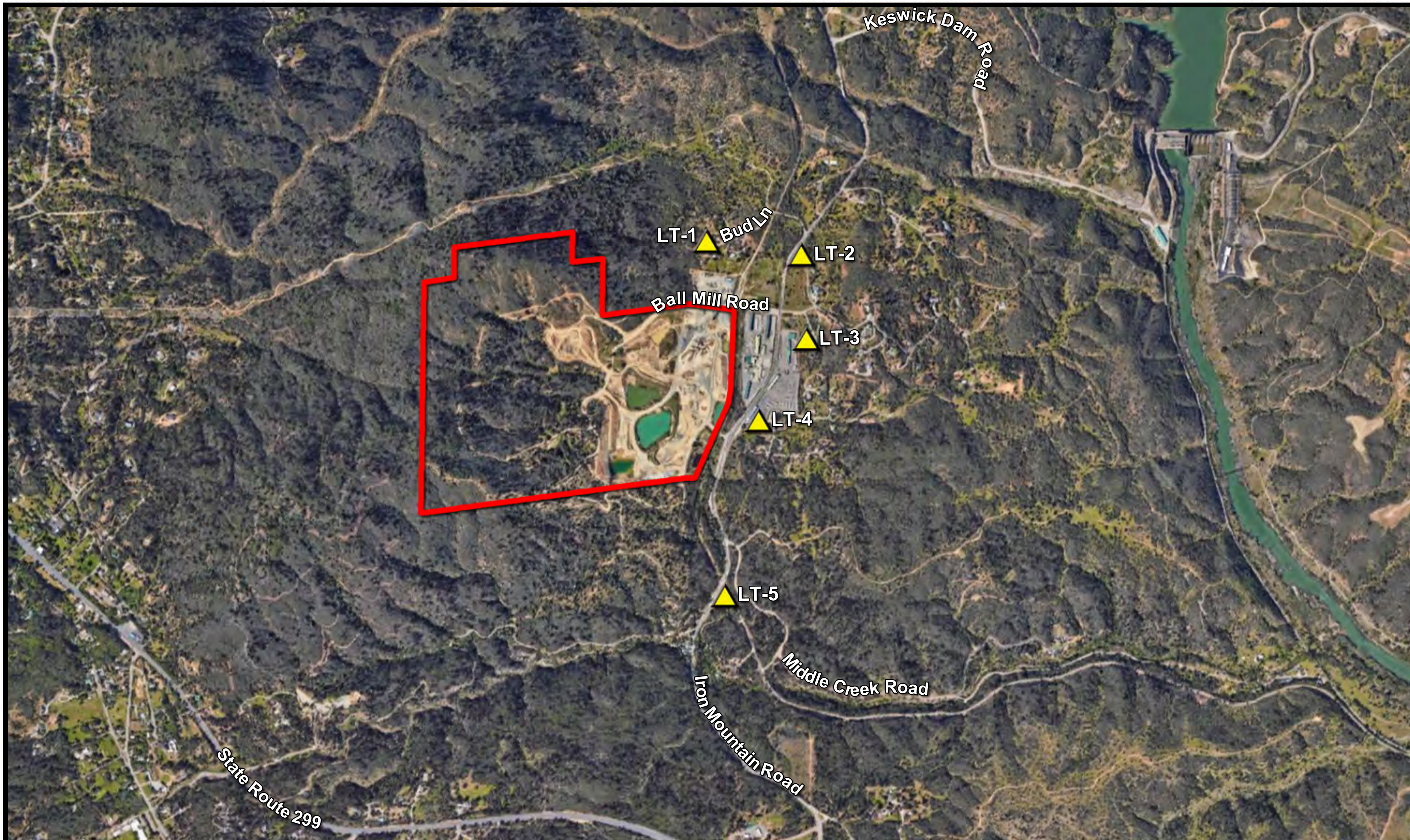
CCA is currently permitted to mine and process aggregate materials between the hours of 6 AM and 6 PM, Monday through Saturday, with the annual tonnage of processed rock product limited to 250,000 tons. In addition, truck traffic to and from the CCA site is limited to a monthly average of 46 round trips per day with a maximum of 110 trips per day (55 round trips).

The proposed Project would expand the facility operations as follows:

- Increase rock product processing from 250,000 to 500,000 tons per year.
- Increase truck traffic to a monthly 110 round trips per day with a maximum of 220 trips per day.[1]
- Increase blasting from 12 to 24 times per year only between 9:30 AM to 3:30 PM, Monday through Friday, with a minimum two-week notice to the Planning Division.
- Hours of operation would remain the same as currently approved:
  - 6 AM to 5 PM Pacific Standard Time (PST). Monday through Friday.
  - 6 AM to 6 PM PST. Saturday.
  - 6 AM to 6 PM Pacific Daylight Time (PDT). Monday through Friday.
  - 6 AM to 5 PM PDT. Saturday.
- Increase the December 31, 2072 "sunset" year to December 31, 2101.
- Importation of 100,000 tons of materials such as topsoil.

Because the Project would result in increased production and increased truck trip generation, this analysis has been prepared to assess potential noise and vibration impacts of the Project. This analysis specifically assesses the Project's compliance with applicable Shasta County and California Environmental Quality Act (CEQA) noise criteria and recommends mitigation measures where noise impacts are identified.

[1] The July 7, 2022 Draft Traffic Impact Analysis Report by GHD states on page 19 that the monthly daily "average is more likely to be 184 truck trips which is based on previous operations. In capturing a conservative approach, the traffic analysis did evaluate the maximum daily truck trips of 220 trips." The 220 truck trips equate to 110 truck round trips.



Legend

Project Border (Approximate)

Long-Term Noise Measurement Locations

N

Scale (feet)

0 600 1200

Crystal Creek Aggregates
Expansion Project
Shasta County, California

Project Area

Figure 1

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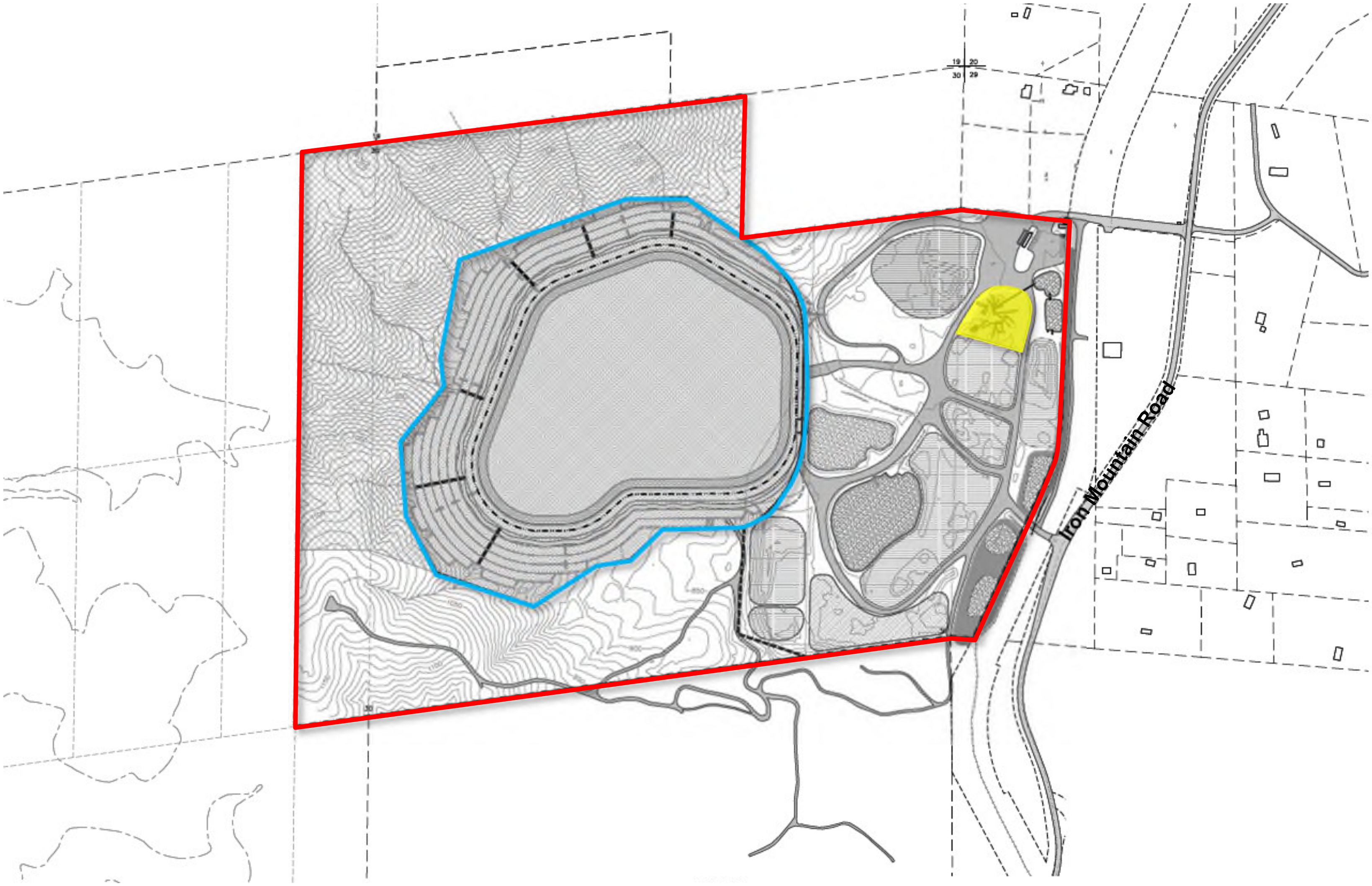

Legend

- Project Site Boundary
- Mine Boundary
- Existing Crushing & Screening Plant

N

Scale (Feet)

0 500 1000

Crystal Creek Aggregates
Expansion Project
Shasta County, California

Site Plan

Figure 2

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Objectives of this Analysis

The objectives of this analysis are as follows:

- To provide background information pertaining to the effects of noise and vibration.
- To identify existing noise-sensitive land uses in the immediate project vicinity.
- To describe baseline ambient noise and vibration levels at those nearest noise-sensitive land uses.
- To clearly set out applicable thresholds of significance by using the California Environmental Quality Act (CEQA) Guidelines in concert with Shasta County noise standards.
- To compare existing noise and vibration levels at noise-sensitive receptors and evaluate the significance of project-related noise and vibration impacts.
- To predict project-related noise and vibration levels at the nearest noise-sensitive areas, and to compare those levels against the applicable thresholds of significance.
- To evaluate noise and vibration mitigation options where significant project-related impacts are identified.
- To summarize the results of the analysis into this report for eventual use in the development of the project environmental documents.

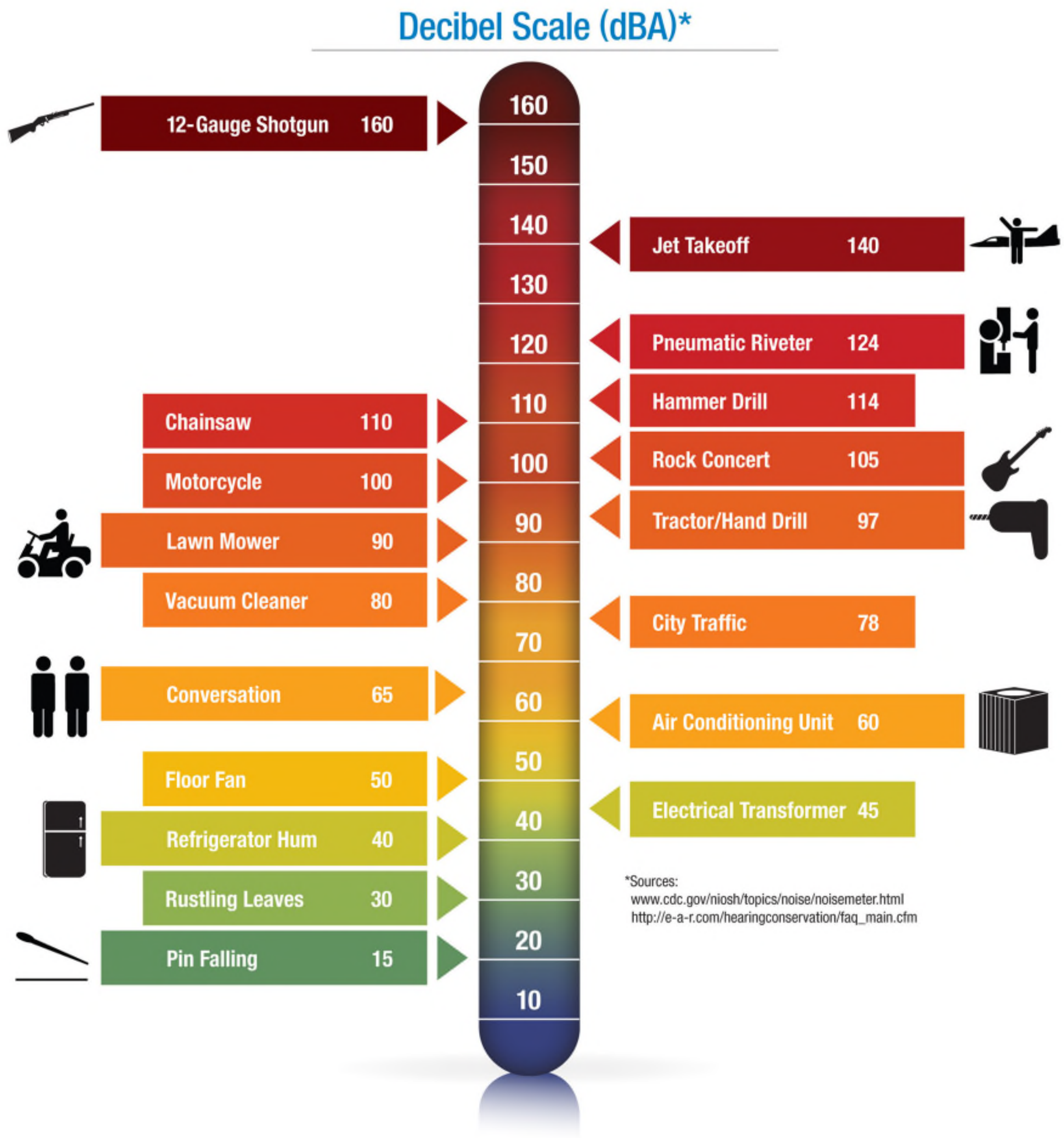
Fundamentals and Terminology

Noise/Sound

Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that human hearing can detect. If the pressure variations occur frequently enough (i.e., at least 20 times per second) they can be identified as sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second or Hertz (Hz). Please see Appendix A for definitions of terminology used in this report.

Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale utilizes the hearing threshold (20 micropascals of pressure) as a point of reference, defined as 0 dB. Other sound pressures are then compared to the reference pressure, and the logarithm is taken to keep the numbers within a practical range. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB. Another useful aspect of the decibel scale is that changes in decibel levels correspond closely to human perception of relative loudness. Figure 3 illustrates common noise levels associated with various sources.

Figure 3
Examples of Noise Levels Associated with Common Noise Sources



The perceived loudness of sound is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by weighting the frequency response of a sound level meter by means of the standardized A-weighting network. There is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. All noise levels reported in this section are A-weighted.

Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}) over a given time period (usually one hour). The L_{eq} is the foundation of the Day-Night Average Level noise descriptor, L_{dn}, and shows very good correlation with community response to noise.

The Day-Night Average Level (L_{dn}) is based upon the average noise level over a 24-hour day, with a +10 decibel weighing applied to noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because L_{dn} represents a 24-hour average, it tends to disguise short-term variations in the noise environment. L_{dn} based noise standards are commonly used to assess noise impacts associated with traffic, railroad and aircraft noise sources.

Audibility

It should be noted that audibility is not a test of significance according to the California Environmental Quality Act (CEQA). If this were the case, any project which added any audible amount of noise to the environment would be considered significant according to CEQA. Because every physical process creates noise, the use of audibility alone as significance criteria would be unworkable. CEQA requires a substantial increase in noise levels before noise impacts are identified, not simply an audible change. The discussion of what constitutes a substantial change in noise environments, both existing and cumulative, is provided in the Regulatory Setting section of this report.

Single-Event Noise & Sleep Disturbance

A single event is an individual distinct loud activity, such as a blasting event at an aggregate quarry, an aircraft overflight, a train or truck passage, or any other brief and discrete noise-generating activity. Because most noise policies applicable to transportation noise sources are typically specified in terms of 24-hour-averaged descriptors, such as L_{dn} or CNEL, the potential for annoyance or sleep disturbance associated with individual loud events can be masked by the averaging process.

Extensive studies have been conducted regarding the effects of single-event noise on sleep disturbance, with the Sound Exposure Level (SEL) metric being a common metric used for such assessments. SEL represents the entire sound energy of a given single-event normalized into a one-second period regardless of event duration. As a result, the single-number SEL metric contains information pertaining to both event duration and intensity. Another descriptor utilized to assess single-event noise is the maximum, or L_{max}, noise level associated with the event. A problem with utilizing L_{max} to assess single events is that the duration of the event is not considered.

There is currently no definitive consensus regarding the appropriateness of SEL criteria as a supplement or replacement for cumulative noise level metrics such as L_{dn} and CNEL, 24-hour noise descriptors when evaluating sleep disturbance. Nonetheless, because SEL describes a receiver's total noise exposure from a single impulsive event, SEL is often used to characterize noise from individual brief loud events.

Due to the wide variation in test subjects' reactions to noises of various levels (some test subjects were awakened by indoor SEL values of 50 dB, whereas others slept through indoor SEL values exceeding 80 dB), no definitive consensus has been reached with respect to a universal criterion to apply to environmental noise assessments. To the extent that there is any guidance regarding acceptable SEL, the emphasis has been on physiological effects, not on land use planning. The Federal Interagency Committee on Aviation Noise (FICAN) has provided estimates of the percentage of people expected to be awakened when exposed to specific SEL inside a home (FICAN 1997). According to the FICAN study, an estimated 5 to 10% of the population is affected when interior SEL noise levels are between 65 and 81 dB, and few sleep awakenings (less than 5%) are predicted if the interior SEL is less than 65 dB.

Vibration

As a preamble to the discussion of vibration fundamentals below, it should be noted that the proposed Project does not propose the introduction of new substantial sources of vibration. The site currently conducts blasting as part of excavation operations, which will continue to occur under the proposed Project. Similarly, vibration generated by aggregate processing operations (crushing/screening) will continue as it does currently, so no new vibration sources would be introduced relative to mining and processing. Finally, heavy truck passbys typically do not generate appreciable vibration beyond the roadway right-of-way and existing truck passbys on the Project vicinity roadways have been occurring for many years. As a result, increased heavy truck traffic resulting from the project would not constitute a new vibration source in the project vicinity. Despite the fact that the project is not introducing new sources of appreciable vibration generation, an evaluation of Project vibration impacts is, nonetheless, included in this assessment. A discussion of vibration fundamentals follows.

Vibration is like noise in that it involves a source, a transmission path, and a receiver. While vibration is related to noise, it differs in that noise is generally considered to be pressure waves transmitted through air, while vibration is usually associated with transmission through a structure. As with noise, vibration consists of an amplitude and frequency. A person's response to vibration will depend on their individual sensitivity as well as the amplitude and frequency of the source.

Vibration can be described in terms of acceleration, velocity, or displacement. A common practice is to monitor vibration measures in terms of peak particle velocities (inches/second). Standards pertaining to perception as well as damage to structures have been developed for vibration in terms of peak particle velocity.

As vibrations travel outward from the source, they excite the particles of rock and soil through which they pass and cause them to oscillate. Differences in subsurface geologic conditions and distance from the source of vibration will result in different vibration levels characterized by different frequencies and intensities. In all cases, vibration amplitudes will decrease with increasing distance. The maximum rate or velocity of particle movement is the commonly accepted descriptor of the vibration “strength.”

Human response to vibration can be difficult to quantify. Vibration can be felt or heard well below the levels that produce any damage to structures. The duration of the event has an effect on human response, as does the frequency of occurrence. Generally, as the duration and vibration frequency increase, the potential for adverse human response increases.

Baseline Noise and Vibration Environments

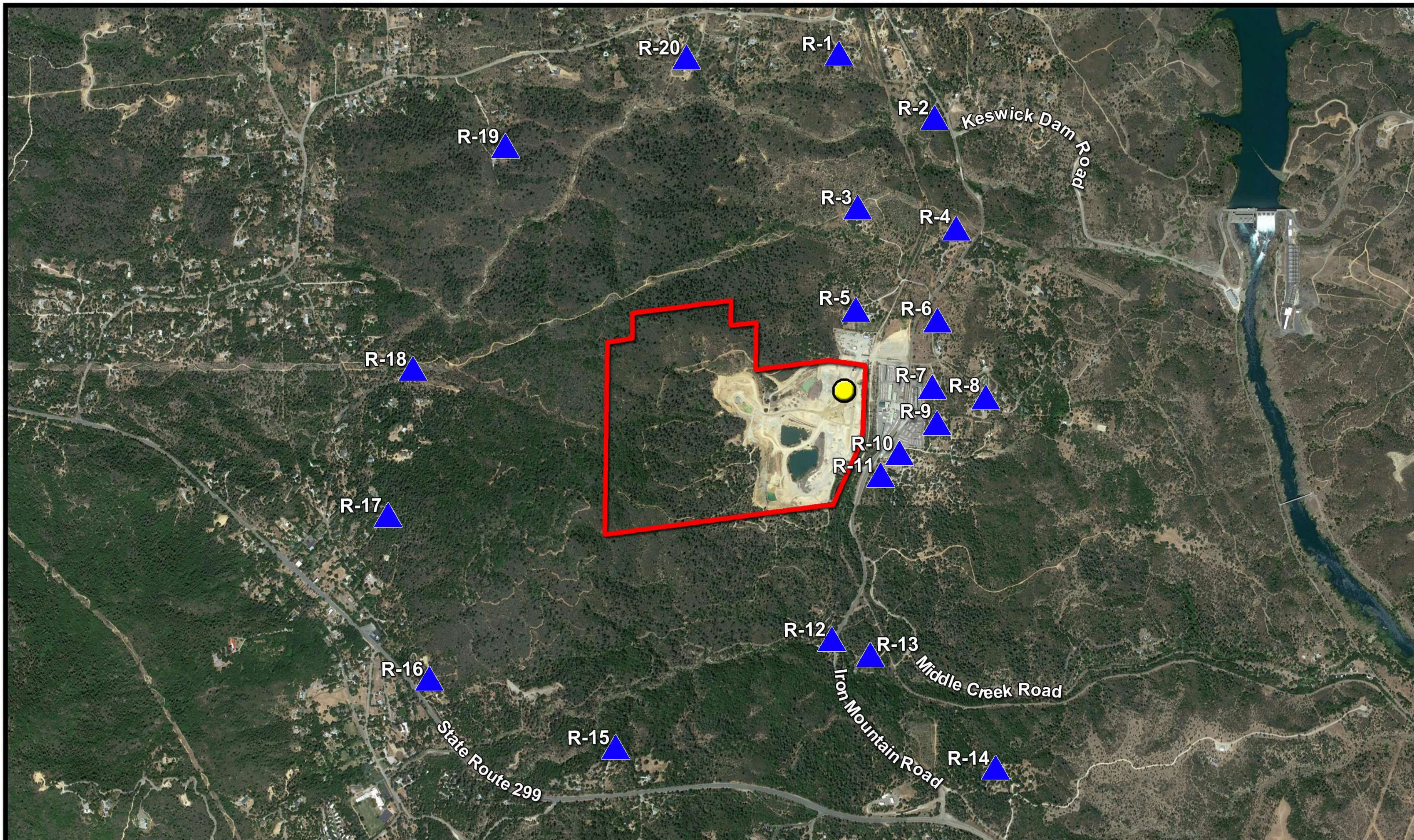
Identification of Existing Sensitive Receptors (Residences)

BAC utilized aerial imagery and site inspections to identify the locations of the nearest representative potentially-affected sensitive receptors to the Project area. It is important to note that it is not necessary to evaluate impacts at every residence or sensitive receptor in the project vicinity. Rather, sensitive receptors with similar noise exposure are typically grouped, with one or more representative receptor(s) selected to be applicable to the larger group. This approach was applied to this analysis.

Since sound decreases with distance, it is also normally unnecessary to model receptors at considerable distances from the project area, particularly if there are closer receptors in the same general direction which are to be analyzed. If no noise impacts are identified at closer receptors, it can normally be concluded that a similar finding would occur at the more distant receptors. Conversely, if impacts are identified at closer receptors, often times mitigation implemented for those closer receptors would benefit the more distant receptors as well, depending on the type of mitigation.

Exceptions to this general rule occur when there are considerable differences in topographic screening between the closer and more distant receptors. In such cases, a closer receptor which is topographically shielded could have a lower project noise exposure than a more distant unshielded receptor. Another exception would occur if the mitigation was receptor specific, rather than project specific.

For this project, a total of 20 receptor locations were selected to represent noise-sensitive uses in the immediate and general project vicinity, including receptors located along project haul routes. The receptors analyzed in this study are depicted graphically on Figure 4. Many of the receptors to the west of the project site are completely shielded from view of the project area by intervening topography. This shielding was considered during the prediction of project noise exposure at those locations.



Legend

Project Border (Approximate)

Existing Processing Plant

Receiver Locations

N

Scale (feet)

0 750 1500

Crystal Creek Aggregates
Expansion Project
Shasta County, California

Receiver Locations

Figure 4

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Overall Ambient Noise Environment

The existing ambient noise environment in the immediate project vicinity is defined by local traffic, industrial operations (including existing CCA operations), and natural sounds (wind, birds, insects, etc.). To generally quantify the existing ambient noise environment in the project area at representative residential receivers nearest to the project site, continuous ambient noise level measurements were conducted at five (5) locations shown on Figure 1 on April 8-9, 2020. The monitoring sites were selected due to their proximity to either the existing and proposed CCA operations (crushing/screening/wash plant) and/or the project haul road. With the exception of Site LT-5, each of the sites had a relatively unobstructed view of the CCA processing area. Site LT-5 had an unobstructed view of Iron Mountain Road.

Larson Davis Laboratories (LDL) precision (Type I) integrating sound level meters were used to complete the ambient noise level measurement surveys. The meters were calibrated before and after use with an LDL Model CAL200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute for Type 1 (Precision) sound measurement equipment (ANSI S1.4). Appendix B shows photographs of the noise measurement sites.

Numerical summaries of the ambient noise level measurement results are provided in Table 1. The Table 1 data include average noise levels recorded for both daytime and nighttime hours (L_{max}, L_{eq}, L_{50}, L_{90}). Appendices C & D show complete tabular and graphical representations of the results, respectively.

Table 1
Ambient Noise Survey Results[1]
Crystal Creek Aggregates Expansion Project Vicinity

		Daytime[3]		Nighttime[3]		
Site[2]	**Date**	**Leq[4]**	**Lmax[5]**	**Leq[4]**	**Lmax[5]**	**Ldn[6]**
1	4/8/2020	46	57	42	58	49
	4/9/2020	52	62	39	51	51
2	4/8/2020	50	65	45	63	52
	4/9/2020	50	67	44	59	52
3	4/8/2020	57	71	50	62	58
	4/9/2020	56	72	45	60	56
4	4/8/2020	53	72	45	65	54
	4/9/2020	52	73	43	64	52
5	4/8/2020	52	67	46	66	54
	4/9/2020	52	69	44	62	53

1. All noise measurement results are A-weighted sound pressure levels (dBA)
2. Noise measurement locations are identified on Figure 1.
3. Daytime hours are 7 AM – 10 PM. Nighttime hours are 10 PM – 7 AM.
4. Leq = Average noise level for the period.
5. Lmax = Average of the highest measured noise levels in each hour of the period.
6. Ldn = Day/Night Average Level. See definition in Appendix A.

The Table 1 data indicate that baseline ambient noise levels present during the ambient noise measurement period were fairly low, with L_{dn} values ranging from 49 to 58 dBA at the measurement sites. Based on existing traffic volumes reported in the Traffic Impact Study prepared for this project (GHD, 7/07/2022), measured baseline ambient noise levels were expected to be substantially higher. For example, the traffic noise prediction model results, which will be discussed later in this report, indicate an existing traffic noise level of 60 dB L_{dn} at measurement Site 5 whereas the survey results indicate measured levels of 53-54 dB L_{dn} at that location. Similar results occurred at the other measurement sites.

BAC believes there are two reasons for the lower-than-expected ambient survey results. The first reason is the presence of the Covid-19 virus, which decreased travel on local roadways during the measurement period. The second reason is believed to be decreased traffic resulting from the large numbers of structures lost during the Carr Fire of 2018 which have yet to be rebuilt. As a result of these factors, ambient conditions present during the survey period were lower than historical conditions. To provide a more typical assessment of ambient conditions in the project vicinity, 5 dB offsets were applied to the measurement results for Sites 1, 2, 4 and 5.

It should be noted that there was construction activity occurring in the general vicinity of Measurement Site 3, which accounts for the higher measured daytime noise levels at that location. As a result, the aforementioned 5 dB offset was not applied to the measurement results at Site 3. After application of the 5 dB offset to the measured ambient conditions, typical daytime average noise levels at the nearest residences to the project site would be approximately 55 – 60 dB L_{eq}, with typical maximum noise levels ranging from approximately 65 to 75 dB L_{max}.

Baseline Traffic Noise Environment

To describe existing noise levels due to traffic, the Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA RD-77-108) was used. The Model is based on the Calveno reference noise factors for automobiles, medium trucks, and heavy trucks – with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the area. The Model was developed to predict hourly L_{eq} values for free-flowing traffic conditions. The day/night distribution of traffic is factored into the Model calculations to assess noise exposure in terms of L_{dn}.

The baseline scenario represents opening year 2022 (existing) annual average non-CCA traffic volumes plus existing CCA truck trips (110 daily trips). The FHWA Model inputs for the existing conditions without any CCA truck trips and for CCA trucks only are included in Appendices E-1 and E-2, respectively. The complete FHWA model results for the baseline scenario are presented in Appendix F, with the summary of those results presented in Table 2.

Table 2
Existing (Baseline) Traffic Noise Levels in Terms of L_{dn}
Crystal Creek Aggregates Project – Shasta County, CA

		Computed L_{dn} (dBA) at Nearest Residences to Each Roadway Segment		
Roadway	**Segment**	**Existing - No CCA Trucks[1]**	**CCA Trucks Only[2]**	**Total Existing (Baseline) Traffic Noise Levels[3]**
Iron Mountain Rd	299 to Middle Creek	61	58	63
Iron Mountain Rd	Middle Creek to CCA South Driveway	52	49	54
Iron Mountain Rd	CCA S Driveway to Stubbs Lane	50	47	52
Iron Mountain Rd	Stubbs Lane to Lumber Mfr Driveway	47	44	49
Iron Mountain Rd	Lumber Mfr Driveway to Ball Mill Road	49	46	51
Iron Mountain Rd	Ball Mill Road to Keswick Dam Road	53	39	53
Iron Mountain Rd	North of Keswick Dam Road	60	49	60
Keswick Dam Rd	East of Iron Mountain Road	59	0	59
Highway 299	West of Iron Mountain Road	68	49	68
Highway 299	East of Iron Mountain Road	68	58	69

Source: FHWA-RD-77-108 with inputs from Appendix E.
1. This column consists of existing traffic conditions without any CCA truck trips included. This is not the baseline as CCA trucks currently operate on these roadways under the current use permit. To arrive at the baseline condition, noise generated by CCA trucks are added to this column (i.e. column 5).
2. This column consists of existing 110 total daily CCA truck trips.
3. This column equals the addition of the Existing condition with no CCA trucks (column 3) to the daily truck noise generation (column 4 - 110 CCA truck trips).

Table 2 indicates that the traffic noise environment in the general project vicinity is more heavily influenced by non-CCA traffic than by CCA-generated traffic. The extent by which the existing ambient noise environment at existing noise-sensitive land uses located in the general project area are affected by existing traffic noise depends primarily on their proximity to the roadways shown in Table 2 and the degree of roadway shielding provided by intervening topography. As such, the Table 2 data is not intended to represent the actual noise exposure of each resident located near the Table 2 roadways. Rather, it is provided to establish baseline noise levels at the nearest identified residences to each roadway segment assuming unshielded conditions.

Baseline CCA Noise Environment

As noted in the project introduction, CCA is currently permitted to operate between the hours of 6 AM and 6 PM. During BAC site visits it was noted that excavation and processing plant operations typically commenced during the 7 AM hour despite the permitted 6 AM start time. As a result, current operations typically occur during daytime hours (7 AM – 10 PM). With the exception of the currently permitted 6 AM start time, excavation and processing would not occur during nighttime hours under the proposed project.

BAC used reference noise level data collected at the CCA site to project CCA noise exposure at the nearest sensitive receptors. SoundPlan Version 8.2, a three-dimensional noise prediction model capable of accounting for variations in noise sources, receiver locations, intervening ground topography, ground absorption, intervening structures, vegetation, and atmospheric conditions, was used for the projections of existing CCA noise levels at the nearest receptors. Table 3 shows the predicted existing CCA noise levels for the most significant noise sources at the nearest receptors. Figure 5 illustrates the noise contours for the existing CCA on-site operations.

Table 3
Existing Crystal Creek Aggregates Noise Levels at Nearest Representative Receptors
Average Daytime Noise Levels (Leq, dBA)

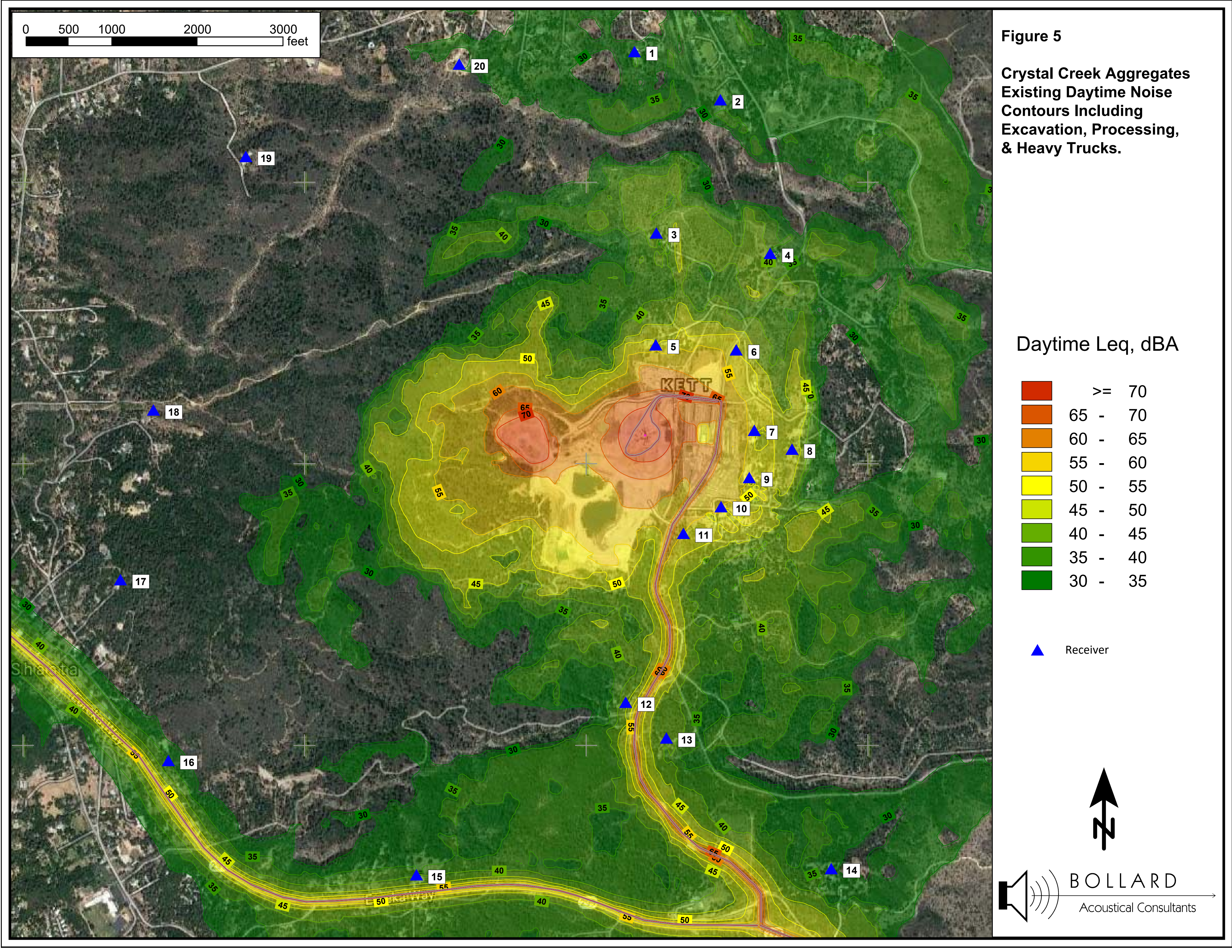
	Noise Source			
Receiver[1]	**Aggregate Plant**	**Excavation**	**Heavy Trucks**	**Total**
1	30	22	22	31
2	33	27	13	34
3	43	27	23	43
4	39	31	24	39
5	53	27	41	53
6	51	41	40	52
7	53	43	44	54
8	46	39	36	47
9	53	43	41	53
10	53	44	43	54
11	53	45	48	55
12	20	20	44	44
13	29	29	41	41
14	28	29	29	33
15	28	28	40	40
16	3	5	35	35
17	8	9	19	20
18	16	17	0	19
19	25	11	0	25
20	30	13	14	30

1. Receiver locations are shown on Figure Source: Bollard Acoustical Consultants, Inc. (BAC) with SoundPlan V 8.2 and on-site reference levels collected at CCA.

As indicated in Table 3, predicted existing noise levels resulting from CCA operations range from approximately 19 to 55 dBA at the nearest noise-sensitive receptors (residences) to the project site.

Baseline Vibration Environment

The existing ambient vibration environment beyond the project boundaries is extremely low. BAC staff subjectively evaluated the baseline vibration environment in the immediate project vicinity as being imperceptible. Because the threshold of perception for vibration is approximately 0.01 inches/second, existing vibration levels are considered to be below that threshold.


0 500 1000 2000 3000 feet
Figure 5
Crystal Creek Aggregates Existing Daytime Noise Contours Including Excavation, Processing, & Heavy Trucks.
Daytime Leq, dBA
>= 70
65 - 70
60 - 65
55 - 60
50 - 55
45 - 50
40 - 45
35 - 40
30 - 35
Receiver
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Criteria for Acceptable Noise Exposure

In California, cities and counties are required to adopt a noise element as part of their general plan. Cities and counties can also adopt noise control requirements within their zoning ordinances or as a separate noise ordinance. The project site is located in Shasta County, which has an adopted Noise Element. Applicable noise-level criteria for Shasta County are discussed below.

Shasta County General Plan Noise Element

For residential uses affected by transportation noise sources (i.e. off-site traffic), the County's Noise Element identifies 60 dB L_{dn} as an acceptable noise exposure limit.

For residential uses affected by non-transportation noise sources (stationary or mobile sources on private property), the Shasta County General Plan establishes performance standards as presented in Table 4. For this project, the evaluation period is considered to be the worst-case hours during which on-site equipment would be operating. Each of the noise level standards specified in Table 4 are reduced by five (5) dBA for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises. The County can impose noise level standards which are more restrictive than the Table 4 standards based upon determination of existing low ambient noise levels. In addition, in rural areas where large lots exist, the exterior noise level standard shall be applied at a point 100' away from the residence.

Table 4
Noise Level Performance Standards for New Projects Affected by or Including Non-Transportation Sources

	Noise Level, dB	
Noise Level Descriptor	**Daytime (7 a.m.-10 p.m.)**	**Nighttime (10 p.m.-7 a.m.)**
Hourly Leq, dB	55	50

Source: Shasta County Noise Element

Criteria for Determining Significance of Project-Related Noise Increases

CEQA guidelines require assessment of a project's noise impacts relative to both established local noise standards and existing noise conditions present without the project. The local noise standards of Shasta County were described in the previous section. This section pertains to criteria for assessing the significance of project-related increases in existing ambient noise conditions.

While CEQA requires that noise impacts be assessed relative to ambient noise levels which are present without the project, CEQA does not provide guidance as to numeric thresholds which should be employed to evaluate impacts. Shasta County General Plan Policy N-g identifies thresholds for findings of significant noise increases related to roadway improvement projects, but that policy doesn't specifically pertain to increases in off-site traffic noise levels resulting from increased traffic resulting from a non-roadway improvement project, such as the CCA Project. That said, the Shasta County thresholds for finding of significant noise increases in General Plan Policy N-g are consistent with recommendations made by the Federal Interagency Commission on Noise (FICON), which are described below.

FICON has developed a graduated scale for guidance in the identification of the significance of project-related noise level increases. Table 5 was developed by FICON as a means of establishing thresholds for impact identification for project-related noise level increases. The rationale for the graduated scale is that test subject's reactions to increases in noise levels varied depending on the starting ambient noise level prior to introducing the increase. Specifically, with lower ambient noise environments, such as those below 60 dB L_{dn}, a larger increase in noise levels was determined to be required to achieve a negative reaction than was necessary in more elevated noise environments.

Table 5
Significance of Changes in Cumulative Noise Exposure

Ambient Noise Level (No Project), dB L_{dn}	Increase Required for Finding of Significance, dB
<60	+5 or more
60-65	+3 or more
>65	+1.5 or more

Source: Federal Interagency Committee on Noise (FICON)

Based on the FICON research, a 5 dB increase in noise levels due to a project is required for a finding of significant noise impact where ambient noise levels without the project are less than 60 dB L_{dn}. Where pre-project ambient conditions are between 60 and 65 dB L_{dn}, a 3 dB increase is applied as the standard of significance. Finally, in areas already exposed to higher noise levels – specifically pre-project noise levels in excess of 65 dB L_{dn} – a 1.5 dB increase is considered by FICON as the threshold of significance. These thresholds are identical to those established in General Plan Policy N-g for assessing impacts related to roadway improvement projects. As a result, the Table 5 criteria are applied to this project for the evaluation of increases in noise levels resulting from the project.

Summary of Noise Criteria Applied to this Study

For this analysis, it is assumed that a project-related noise impact would occur if noise level increases from on-site project-related activities would exceed the Shasta County Noise criteria presented in Table 4, or if project-generated noise levels would cause noise level increases in excess of the FICON thresholds shown above in Table 5.

Criteria for Acceptable Vibration Exposure

Human and structural response to different vibration levels is influenced by a number of factors, including ground type, distance between source and receptor, duration, and the number of perceived vibration events. Table 6 indicates that the threshold for damage to structures ranges from 2 to 6 in/sec peak particle velocity (ppv). One-half this minimum threshold, or 1 in/sec ppv is considered a criterion that would protect against significant architectural or structural damage. The general threshold at which human annoyance could occur is noted as one tenth of that level, or 0.1 in/sec ppv.

Table 6
General Human and Structural Responses to Vibration Levels

Effects on Structures and People	Peak Vibration Threshold (in./sec. ppv)
Structural damage to commercial structures	6
Structural damage to residential structures	2
Architectural damage to structures (cracking, etc.)	1
General threshold of human annoyance	0.1
General threshold of human perception	0.01

Sources: Transit Noise and Vibration Impact Assessment Manual (FTA, 2018) & Transportation and Construction Vibration Guidance Manual (Caltrans, 2013)

Noise Generation of the Proposed Project

Project-Related Noise Sources

The primary noise-generating components of the project will consist of additional mining & processing, and increased heavy truck traffic on the roadway network utilized by project traffic resulting from the increase in annual production from 250,000 to 500,000 tons per year. The following sections evaluate noise impacts related to these noise sources.

Location of Project Noise Sources

Figure 2 shows the proposed site plan with the increased mining boundaries and location of the existing processing plant (crushing and screening). Increases in off-site heavy truck traffic will occur on the same roadway segments as currently utilized by existing CCA truck traffic.

Reference Noise Levels for Project Noise Sources

BAC utilized noise level data collected at the CCA project site to establish reference noise levels for mining and processing equipment. For the prediction of on-site and off-site heavy truck movement noise generation, BAC used the FHWA traffic noise prediction model.

Prediction of Project-Related Noise Levels at Nearest Residences

With the exception of the currently permitted beginning 6 AM hour of operations during PST hours, the processing plant and excavation operations would not occur during nighttime hours. This analysis evaluates impacts associated with the increase in production (excavation, processing, and loadout), during daytime hours.

To predict noise impacts related to the Project, the SoundPlan model was again utilized. Table 7 summarizes the SoundPlan predicted noise exposure from the increase in facility operations. Table 7 also includes the effects of the other noise sources operating during those time periods, as well as the effects of intervening topography and ground cover. Standard day atmospheric conditions were assumed for the modeling procedure.

Figure 6 shows the noise contours associated with the proposed excavation, aggregate processing, and increased heavy truck traffic associated with the project.

Table 7
Existing + Project Daytime Noise Levels at Nearest Residences (Leq, dBA)
Crystal Creek Aggregates, Shasta County CA

Receiver	Existing CCA Noise Level (Table 3)	Existing Plus Project Daytime CCA Noise Levels: Aggregate Plant	Excavation	Heavy Trucks	Total Project	Increase over Existing	Significant Increase
1	31	30	24	25	32	1	No
2	34	33	28	16	34	0	No
3	43	43	31	27	43	0	No
4	39	39	32	27	40	0	No
5	53	52	30	44	53	0	No
6	52	51	40	43	52	0	No
7	54	53	42	47	54	0	No
8	47	46	38	39	47	0	No
9	53	53	42	44	54	0	No
10	54	53	43	46	54	0	No
11	55	53	44	51	56	1	No
12	44	20	21	47	47	3	No
13	41	29	30	44	44	3	No
14	33	28	28	32	34	1	No
15	40	28	26	42	42	2	No
16	35	3	5	37	37	2	No
17	20	8	11	21	22	2	No
18	19	16	17	3	19	0	No
19	25	25	16	3	25	0	No
20	30	30	13	17	30	0	No

Source: Bollard Acoustical Consultants, Inc. (BAC) with SoundPlan V8.2 and on-site reference levels collected at CCA.

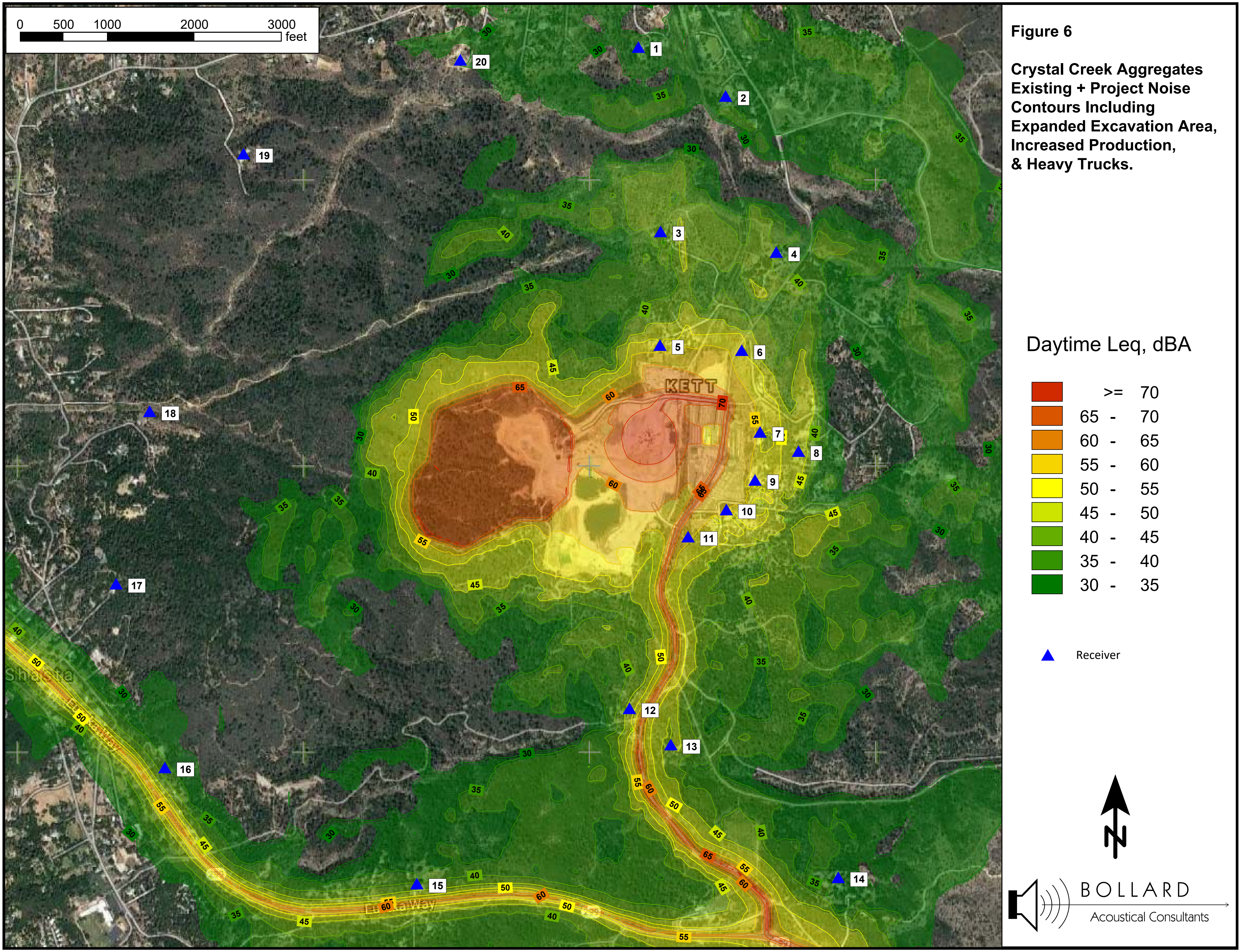

Figure 6

Crystal Creek Aggregates Existing + Project Noise Contours Including Expanded Excavation Area, Increased Production, & Heavy Trucks.

Analysis of Project Related Noise Levels and Noise Level Increases

The Table 7 data indicate that noise generated by on-site noise sources due to increased aggregate production (excavation, aggregate plant processing, and heavy truck operations), would be below the County's 55 dB L_{eq} daytime noise level standard at the nearest sensitive receptors. Table 7 also indicates that the increase in average noise levels at the nearest receptors would be less than significant. As a result, this analysis concludes that the ***noise impacts of the project would be less than significant.***

Prediction of Project Traffic Noise Level Increases in Terms of Ldn

To assess impacts relative to increases in 24-hour traffic noise levels resulting from the project, the Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA RD-77-108) was used. Traffic volumes for project conditions were obtained from the Traffic Impact Study prepared by GHD.

Table 8 shows the project-related increases in off-site traffic noise levels at the nearest receptors located along each roadway segment, and whether or not those increases would be considered significant relative to the Table 4 criteria. The FHWA Model inputs and results for the plus-project scenarios are provided in Appendices E and F, respectively. As indicated in Table 8, no significant increases in traffic noise levels are predicted along any of the roadway segments as a result of the project. Therefore ***this impact is considered less than significant***.

Table 8
Predicted Off-Site Traffic Noise Levels and Project Related Traffic Noise Level Increases
Crystal Creek Aggregates Project – Shasta County, CA

		Computed Ldn (dBA) at Nearest Residences to Each Roadway Segment				
Roadway	**Segment**	**Total Existing (Baseline) Traffic Noise Levels[1]**	**Additional CCA Project Trucks[2]**	**Baseline + Project Traffic Noise Levels[3]**	**Project-Related Traffic Noise Level Increase[4]**	**Significant Increase?[5]**
Iron Mountain Rd	299 to Middle Creek	63	58	64	1.3	No
Iron Mountain Rd	Middle Creek to CCA South Driveway	54	49	55	1.3	No
Iron Mountain Rd	CCA S Driveway to Stubbs Lane	52	47	53	1.3	No
Iron Mountain Rd	Stubbs Lane to Lumber Mfr Driveway	49	44	50	1.3	No
Iron Mountain Rd	Lumber Mfr Driveway to Ball Mill Road	51	46	52	1.3	No
Iron Mountain Rd	Ball Mill Road to Keswick Dam Road	53	39	53	0.2	No
Iron Mountain Rd	North of Keswick Dam Road	60	49	61	0.3	No
Keswick Dam Rd	East of Iron Mountain Road	59	0	59	0.0	No
Highway 299	West of Iron Mountain Road	68	49	68	0.1	No
Highway 299	East of Iron Mountain Road	69	58	69	0.4	No

Source: FHWA-RD-77-108 with inputs from Appendix E.
1. This column consists of existing traffic conditions including annual average CCA truck trips from Table 2 (110 existing daily CCA truck trips).
2. This column consists of the noise generated due to the additional 250,000 tons of annual production under the proposed project (110 additional daily CCA truck trips).
3. This column equals of the sum of the existing and project traffic noise levels.
4. This column represents the project-related increase in traffic noise levels due to the project on an annual average basis.
5. This column identified whether or not the increase is considered significant. This determination is made based on the Table 5 criteria, the baseline levels shown in Column 3, and on the project-related traffic noise level increase shown in Column 6.

Vibration Generation of the Proposed Project

With the exception of vibration generated by blasting events, which are part of the current baseline environment, the project is not expected to produce any discernible increases in vibration levels at the nearest sensitive receptors (residences) in the project vicinity. This is due to the fact that heavy truck passbys are not impulsive in nature, due to the substantial intervening topography, and due to the relatively large distances between the project operations and nearest receivers. As such, the potential impact associated with project-generated vibration (i.e. increased mining and production, and increased off-site heavy truck traffic) is predicted to be less than significant.

Table 9 shows reference peak particle velocity (PPV) and VdB (rms) vibration levels for a variety of heavy earthmoving equipment. The Table 9 data is provided at a reference distance of 25 feet from the source.

Table 9
Vibration Levels of Heavy Earthmoving Equipment – 25 Foot Reference Distance

Source	Peak Particle Velocity (PPV) inches/second	RMS Velocity in Decibels (VdB)
Water Trucks	0.001	57
Scraper	0.002	58
Bulldozer - Small	0.003	58
Backhoe	0.051	82
Excavator	0.051	82
Grader	0.051	82
Loader	0.051	82
Loaded Trucks	0.076	86
Bulldozer - Large	0.089	87

Source: FTA and FHWA

The nearest receptor is about 800 feet from the proposed stock pile in which a bulldozer would operate. The nearest receptor to the haul routes is approximately 50 feet from Iron Mountain Road. To project vibration levels from the reference distance of 25 feet shown in Table 9 to the nearest receptors, the following formula is applied:

$$PPV = PPV\ ref * (25 / D)^n \text{ (inches/second)}$$

Where:

PPV = Desired vibration level at receptor located D feet from the vibration source
D = Distance from vibration source to sensitive receptor (feet)
n = Vibration attenuation rate through ground.

According to Chapter 12 of the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment (Federal Transit Administration, 2006) manual, an “n” value of 1.5 is recommended to calculate vibration propagation through typical soil conditions.

Using the formula provided above, and the worst-case vibration level shown in Table 9 (Bulldozer - Large), the vibration level at the nearest sensitive receptor computes to 0.0005 inches/second PPV. For heavy truck passbys, the computed vibration level at the nearest receptor is 0.03 inches/second PPV. These levels are well below vibration levels required to cause damage to structures and below the threshold for annoyance at even the closest receptors. As a result, ***this impact is considered less than significant***.

Cumulative Noise Impacts

The noise generation of the proposed project would not increase over time because heavy truck passbys and the frequency of those passbys are limited by the use permit. Although background ambient noise levels will inevitably increase over time, that increase will provide a higher ambient background against which the noise generation of the project would be overlaid, thereby resulting in reduced significance of project noise over time. As a result, the worst-case noise impacts of the project would not occur relative to future (cumulative) conditions, but against existing baseline conditions. Therefore, cumulative noise impacts of the project are anticipated to be ***less than significant.***

Summary of Impacts and Mitigation Measures

As noted in the previous sections, project related and cumulative noise impacts associated with the proposed Crystal Creek Aggregates (CCA) Expansion Project are predicted to be ***less than significant***. This includes noise generated from on-site noise sources resulting from increased production and off-site increases in truck traffic. Therefore, ***no mitigation measures*** are necessary.

The potential impact associated with project-generated vibration (i.e. increased mining and production, and increased off-site heavy truck traffic) is predicted to be ***less than significant*** and ***no mitigation measures*** are required.

Appendix A
Acoustical Terminology

Acoustics The science of sound.

Ambient Noise The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.

Attenuation The reduction of an acoustic signal.

A-Weighting A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.

Decibel or dB Fundamental unit of sound. A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.

CNEL Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.

Frequency The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.

IIC Impact Insulation Class (IIC): A single-number representation of a floor/ceiling partition's impact generated noise insulation performance. The field-measured version of this number is the FIIC.

L_{dn} Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.

L_{eq} Equivalent or energy-averaged sound level.

L_{max} The highest root-mean-square (RMS) sound level measured over a given period of time.

Loudness A subjective term for the sensation of the magnitude of sound.

Masking The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound.

Noise Unwanted sound.

Peak Noise The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the "Maximum" level, which is the highest RMS level.

RT_{60} The time it takes reverberant sound to decay by 60 dB once the source has been removed.

STC Sound Transmission Class (STC): A single-number representation of a partition's noise insulation performance. This number is based on laboratory-measured, 16-band (1/3-octave) transmission loss (TL) data of the subject partition. The field-measured version of this number is the FSTC.

Legend

A LT-1: 40°36'30.59"N, 122°27'55.62"W

B LT-2: 40°36'29.00"N, 122°27'42.06"W

C LT-2: 40°36'29.00"N, 122°27'42.06"W

D LT-3: 40°36'19.40"N, 122°27'41.79"W

Note: Long-term monitoring completed on April 8 & 9, 2020.

Crystal Creek Aggregates
Expansion Project
Shasta County, California

Photographs of Survey Locations

Appendix B-1

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A


B


C


D

Legend

- A LT-3: 40°36'19.40"N, 122°27'41.79"W
- B LT-4: 40°36'11.19"N, 122°27'47.92"W
- C LT-4: 40°36'11.19"N, 122°27'47.92"W
- D LT-5: 40°35'52.48"N, 122°27'52.78"W

Note: Long-term monitoring completed on April 8 & 9, 2020.

Crystal Creek Aggregates
Expansion Project
Shasta County, California

Photographs of Survey Locations

Appendix B-2

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Acoustical

Appendix C-1
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 1
Wednesday, April 08, 2020

Hour	Leq	Lmax	L50	L90
12:00 AM	45	76	40	36
1:00 AM	37	54	36	32
2:00 AM	38	60	33	29
3:00 AM	34	56	31	28
4:00 AM	32	47	30	29
5:00 AM	34	51	31	29
6:00 AM	48	70	44	32
7:00 AM	52	62	51	46
8:00 AM	46	58	44	42
9:00 AM	45	60	44	42
10:00 AM	45	56	44	41
11:00 AM	45	61	44	42
12:00 PM	46	57	45	42
1:00 PM	46	64	44	41
2:00 PM	46	57	45	42
3:00 PM	45	54	44	41
4:00 PM	45	57	44	40
5:00 PM	42	57	39	34
6:00 PM	37	54	32	28
7:00 PM	39	56	35	29
8:00 PM	47	52	47	45
9:00 PM	45	56	45	43
10:00 PM	43	54	42	40
11:00 PM	39	54	38	35

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	52	37	46	48	32	42
Lmax (Maximum)	64	52	57	76	47	58
L50 (Median)	51	32	43	44	30	36
L90 (Background)	46	28	40	40	28	32

Computed Ldn, dB	49
% Daytime Energy	80%
% Nighttime Energy	20%

GPS Coordinates	40°36'30.59"N 122°27'55.62"W

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Appendix C-2
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 1
Thursday, April 09, 2020

Hour	Leq	Lmax	L50	L90
12:00 AM	36	44	36	32
1:00 AM	34	55	32	28
2:00 AM	32	51	29	26
3:00 AM	33	46	28	26
4:00 AM	34	51	29	27
5:00 AM	35	51	31	28
6:00 AM	46	61	45	35
7:00 AM	50	70	47	41
8:00 AM	49	61	49	46
9:00 AM	52	66	51	49
10:00 AM	52	60	52	43
11:00 AM	53	65	53	50
12:00 PM	55	65	55	52
1:00 PM	54	67	54	51
2:00 PM	54	63	53	49
3:00 PM	55	68	55	52
4:00 PM	55	62	55	51
5:00 PM	42	62	39	33
6:00 PM	42	68	40	36
7:00 PM	37	54	34	31
8:00 PM	41	52	41	39
9:00 PM	40	53	38	35
10:00 PM	39	50	39	36
11:00 PM	40	49	40	38

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	55	37	52	46	32	39
Lmax (Maximum)	70	52	62	61	44	51
L50 (Median)	55	34	48	45	28	34
L90 (Background)	52	31	44	38	26	31

Computed Ldn, dB	51
% Daytime Energy	97%
% Nighttime Energy	3%

GPS Coordinates	40°36'30.59"N 122°27'55.62"W

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Appendix C-3
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 2
Wednesday, April 08, 2020

Hour	Leq	Lmax	L50	L90
12:00 AM	44	71	41	38
1:00 AM	44	64	40	37
2:00 AM	40	60	37	35
3:00 AM	40	62	35	33
4:00 AM	42	59	35	34
5:00 AM	45	63	35	33
6:00 AM	51	66	44	35
7:00 AM	51	63	49	44
8:00 AM	51	67	46	42
9:00 AM	50	62	46	42
10:00 AM	49	67	45	40
11:00 AM	49	62	46	41
12:00 PM	51	66	47	42
1:00 PM	51	63	47	41
2:00 PM	50	64	46	40
3:00 PM	50	62	46	40
4:00 PM	51	71	45	40
5:00 PM	50	66	44	37
6:00 PM	48	67	41	36
7:00 PM	49	62	46	40
8:00 PM	50	64	48	45
9:00 PM	46	70	43	41
10:00 PM	44	58	42	40
11:00 PM	44	61	41	39

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	51	46	50	51	40	45
Lmax (Maximum)	71	62	65	71	58	63
L50 (Median)	49	41	46	44	35	39
L90 (Background)	45	36	41	40	33	36

Computed Ldn, dB	52
% Daytime Energy	84%
% Nighttime Energy	16%

GPS Coordinates	40°36'29.00"N 122°27'42.06"W

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Appendix C-4
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 2
Thursday, April 09, 2020

Hour	Leq	Lmax	L50	L90
12:00 AM	40	58	40	37
1:00 AM	40	65	38	36
2:00 AM	39	55	37	35
3:00 AM	37	55	35	33
4:00 AM	43	61	34	33
5:00 AM	44	63	35	33
6:00 AM	51	64	46	39
7:00 AM	50	65	46	43
8:00 AM	51	64	48	46
9:00 AM	55	83	47	43
10:00 AM	51	71	48	44
11:00 AM	50	68	47	42
12:00 PM	49	60	47	44
1:00 PM	50	69	48	43
2:00 PM	49	63	46	42
3:00 PM	50	64	48	45
4:00 PM	51	68	48	44
5:00 PM	50	73	43	34
6:00 PM	49	68	45	40
7:00 PM	47	64	42	36
8:00 PM	47	69	44	42
9:00 PM	44	58	42	39
10:00 PM	44	58	42	40
11:00 PM	41	56	41	37

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	55	44	50	51	37	44
Lmax (Maximum)	83	58	67	65	55	59
L50 (Median)	48	42	46	46	34	39
L90 (Background)	46	34	42	40	33	36

Computed Ldn, dB	52
% Daytime Energy	87%
% Nighttime Energy	13%

GPS Coordinates	40°36'29.00"N 122°27'42.06"W

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Appendix C-5
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 3
Wednesday, April 08, 2020

Hour	Leq	Lmax	L50	L90
12:00 AM	53	70	51	43
1:00 AM	50	58	44	39
2:00 AM	44	64	40	35
3:00 AM	46	61	41	34
4:00 AM	45	58	42	39
5:00 AM	44	63	36	31
6:00 AM	48	61	43	33
7:00 AM	59	77	55	50
8:00 AM	59	80	55	52
9:00 AM	60	83	55	52
10:00 AM	61	78	58	54
11:00 AM	58	71	56	52
12:00 PM	58	72	56	53
1:00 PM	58	77	54	50
2:00 PM	58	78	54	48
3:00 PM	55	70	52	46
4:00 PM	55	65	53	49
5:00 PM	53	70	50	43
6:00 PM	47	64	39	31
7:00 PM	49	58	46	33
8:00 PM	56	64	56	53
9:00 PM	55	59	54	49
10:00 PM	54	64	54	45
11:00 PM	51	57	48	41

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	61	47	57	54	44	50
Lmax (Maximum)	83	58	71	70	57	62
L50 (Median)	58	39	53	54	36	45
L90 (Background)	54	31	48	45	31	38

Computed Ldn, dB	58
% Daytime Energy	91%
% Nighttime Energy	9%

GPS Coordinates	40°36'19.40"N 122°27'41.79"W

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Appendix C-6
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 3
Thursday, April 09, 2020

Hour	Leq	Lmax	L50	L90
12:00 AM	44	59	39	32
1:00 AM	42	65	33	29
2:00 AM	45	64	39	28
3:00 AM	34	55	30	26
4:00 AM	41	61	31	27
5:00 AM	41	59	32	28
6:00 AM	47	58	45	34
7:00 AM	54	71	52	47
8:00 AM	61	84	56	52
9:00 AM	57	80	54	51
10:00 AM	59	76	57	53
11:00 AM	55	72	53	49
12:00 PM	57	73	53	48
1:00 PM	57	73	55	50
2:00 PM	56	72	53	49
3:00 PM	56	73	54	50
4:00 PM	54	76	51	46
5:00 PM	52	69	48	41
6:00 PM	51	67	49	44
7:00 PM	50	67	48	41
8:00 PM	54	66	54	48
9:00 PM	51	63	49	44
10:00 PM	49	57	45	39
11:00 PM	48	60	42	37

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	61	50	56	49	34	45
Lmax (Maximum)	84	63	72	65	55	60
L50 (Median)	57	48	52	45	30	37
L90 (Background)	53	41	47	39	26	31

Computed Ldn, dB	56
% Daytime Energy	95%
% Nighttime Energy	5%

GPS Coordinates	40°36'19.40"N 122°27'41.79"W

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Appendix C-7
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 4
Wednesday, April 08, 2020

Hour	Leq	Lmax	L50	L90
12:00 AM	43	60	40	33
1:00 AM	41	64	33	30
2:00 AM	40	63	33	30
3:00 AM	43	66	32	29
4:00 AM	42	67	32	30
5:00 AM	44	66	32	29
6:00 AM	52	78	40	32
7:00 AM	53	73	49	45
8:00 AM	56	77	52	50
9:00 AM	58	91	51	48
10:00 AM	53	69	51	47
11:00 AM	53	66	51	48
12:00 PM	55	70	53	49
1:00 PM	56	80	53	47
2:00 PM	53	66	50	45
3:00 PM	53	68	51	45
4:00 PM	52	70	49	45
5:00 PM	51	68	47	36
6:00 PM	50	70	40	30
7:00 PM	48	65	38	31
8:00 PM	50	76	43	40
9:00 PM	43	66	38	36
10:00 PM	41	63	35	33
11:00 PM	39	61	32	30

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	58	43	53	52	39	45
Lmax (Maximum)	91	65	72	78	60	65
L50 (Median)	53	38	48	40	32	34
L90 (Background)	50	30	43	33	29	31

Computed Ldn, dB	54
% Daytime Energy	92%
% Nighttime Energy	8%

GPS Coordinates	40°36'11.19"N 122°27'47.92"W

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Appendix C-8
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 4
Thursday, April 09, 2020

Hour	Leq	Lmax	L50	L90
12:00 AM	33	57	30	28
1:00 AM	36	62	28	26
2:00 AM	39	67	28	26
3:00 AM	35	61	28	25
4:00 AM	42	65	29	26
5:00 AM	42	64	31	27
6:00 AM	50	76	38	30
7:00 AM	51	66	46	41
8:00 AM	52	68	48	44
9:00 AM	51	71	45	41
10:00 AM	51	74	46	42
11:00 AM	53	80	46	40
12:00 PM	55	79	45	40
1:00 PM	54	78	46	41
2:00 PM	53	75	46	41
3:00 PM	55	85	45	40
4:00 PM	52	73	45	40
5:00 PM	54	75	43	36
6:00 PM	48	70	39	34
7:00 PM	46	68	36	33
8:00 PM	50	75	38	34
9:00 PM	43	64	34	32
10:00 PM	41	65	32	29
11:00 PM	37	61	29	26

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	55	43	52	50	33	43
Lmax (Maximum)	85	64	73	76	57	64
L50 (Median)	48	34	43	38	28	30
L90 (Background)	44	32	39	30	25	27

Computed Ldn, dB	52
% Daytime Energy	93%
% Nighttime Energy	7%

GPS Coordinates	40°36'11.19"N 122°27'47.92"W

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Appendix C-9
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 5
Wednesday, April 08, 2020

Hour	Leq	Lmax	L50	L90
12:00 AM	43	63	36	35
1:00 AM	45	70	36	35
2:00 AM	42	66	36	35
3:00 AM	46	65	37	36
4:00 AM	44	63	38	37
5:00 AM	48	72	38	37
6:00 AM	51	67	40	37
7:00 AM	51	64	43	40
8:00 AM	53	67	47	42
9:00 AM	53	67	46	42
10:00 AM	52	67	47	42
11:00 AM	52	64	47	43
12:00 PM	52	67	47	43
1:00 PM	54	68	48	43
2:00 PM	53	69	46	42
3:00 PM	52	66	46	40
4:00 PM	52	70	45	40
5:00 PM	52	70	45	36
6:00 PM	51	68	40	36
7:00 PM	49	65	40	37
8:00 PM	48	64	41	38
9:00 PM	45	68	38	36
10:00 PM	44	65	36	35
11:00 PM	41	61	36	35

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	54	45	52	51	41	46
Lmax (Maximum)	70	64	67	72	61	66
L50 (Median)	48	38	44	40	36	37
L90 (Background)	43	36	40	37	35	36

Computed Ldn, dB	54
% Daytime Energy	86%
% Nighttime Energy	14%

GPS Coordinates	40°35'52.48"N 122°27'52.78"W

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Appendix C-10
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 5
Thursday, April 09, 2020

Hour	Leq	Lmax	L50	L90
12:00 AM	37	59	35	34
1:00 AM	39	63	35	34
2:00 AM	41	66	35	34
3:00 AM	39	60	35	34
4:00 AM	44	64	36	35
5:00 AM	45	64	38	35
6:00 AM	51	66	43	38
7:00 AM	52	69	46	40
8:00 AM	51	68	42	36
9:00 AM	52	72	43	36
10:00 AM	52	74	42	35
11:00 AM	53	71	44	36
12:00 PM	52	67	45	38
1:00 PM	53	72	45	37
2:00 PM	53	77	44	36
3:00 PM	52	65	44	37
4:00 PM	53	72	44	36
5:00 PM	52	74	43	36
6:00 PM	50	70	41	36
7:00 PM	49	64	39	36
8:00 PM	48	63	38	35
9:00 PM	44	62	35	34
10:00 PM	42	62	35	33
11:00 PM	39	58	34	33

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	53	44	52	51	37	44
Lmax (Maximum)	77	62	69	66	58	62
L50 (Median)	46	35	42	43	34	36
L90 (Background)	40	34	36	38	33	35

Computed Ldn, dB	53
% Daytime Energy	90%
% Nighttime Energy	10%

GPS Coordinates	40°35'52.48"N 122°27'52.78"W

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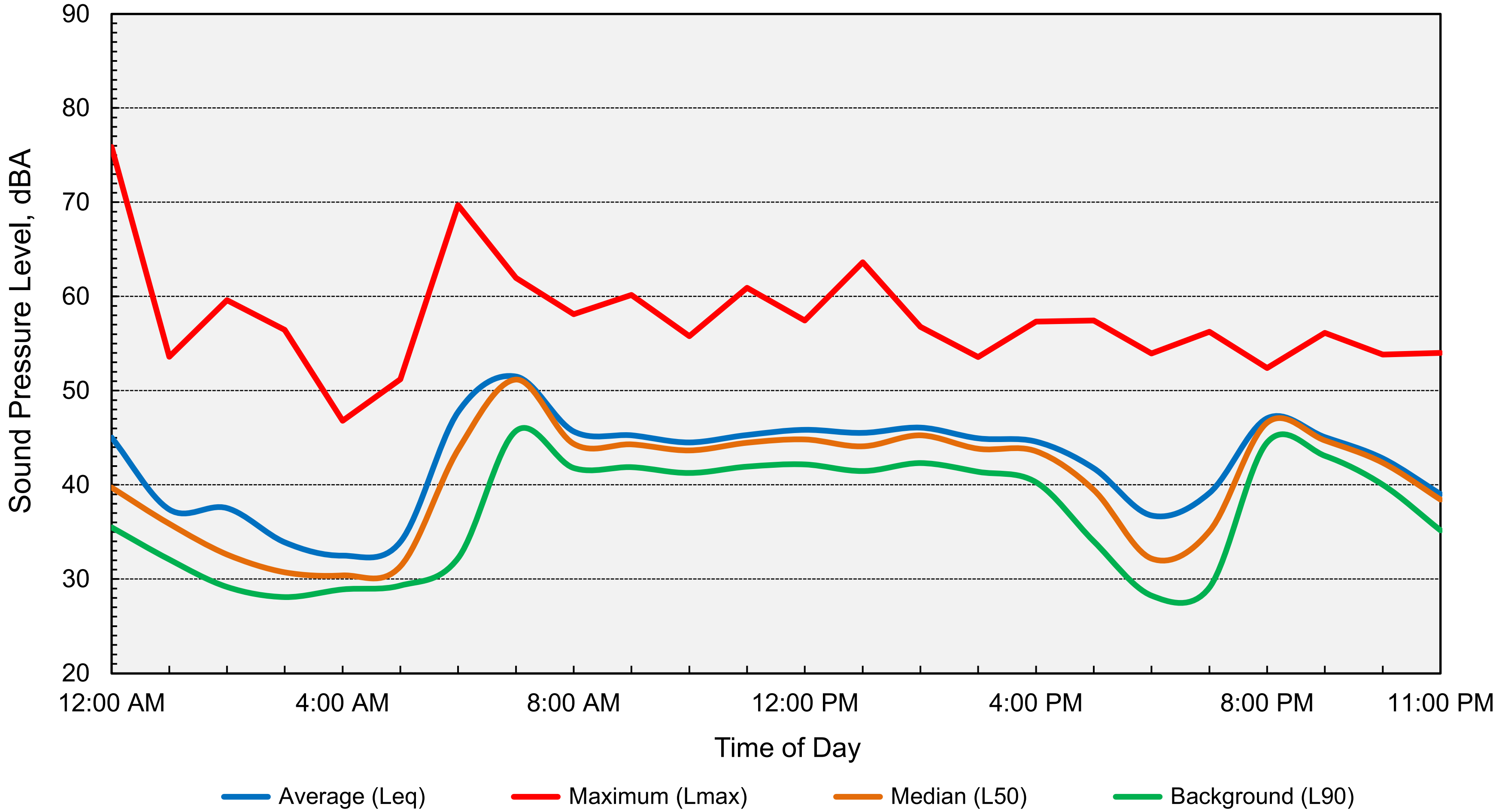
Appendix D-1
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 1
Wednesday, April 08, 2020



Computed Ldn = 49 dB

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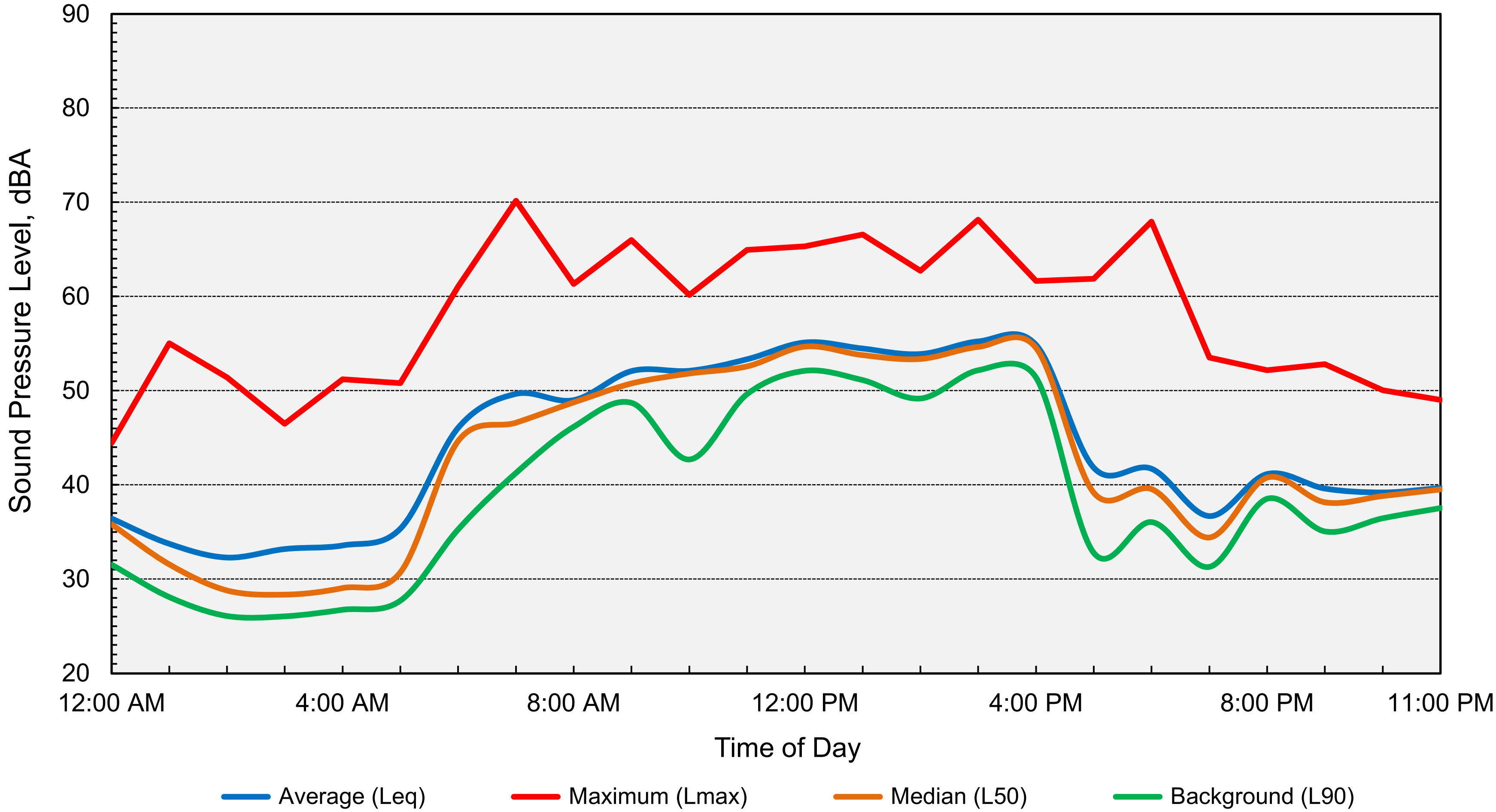
Appendix D-2
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 1
Thursday, April 09, 2020



Computed Ldn = 51 dB

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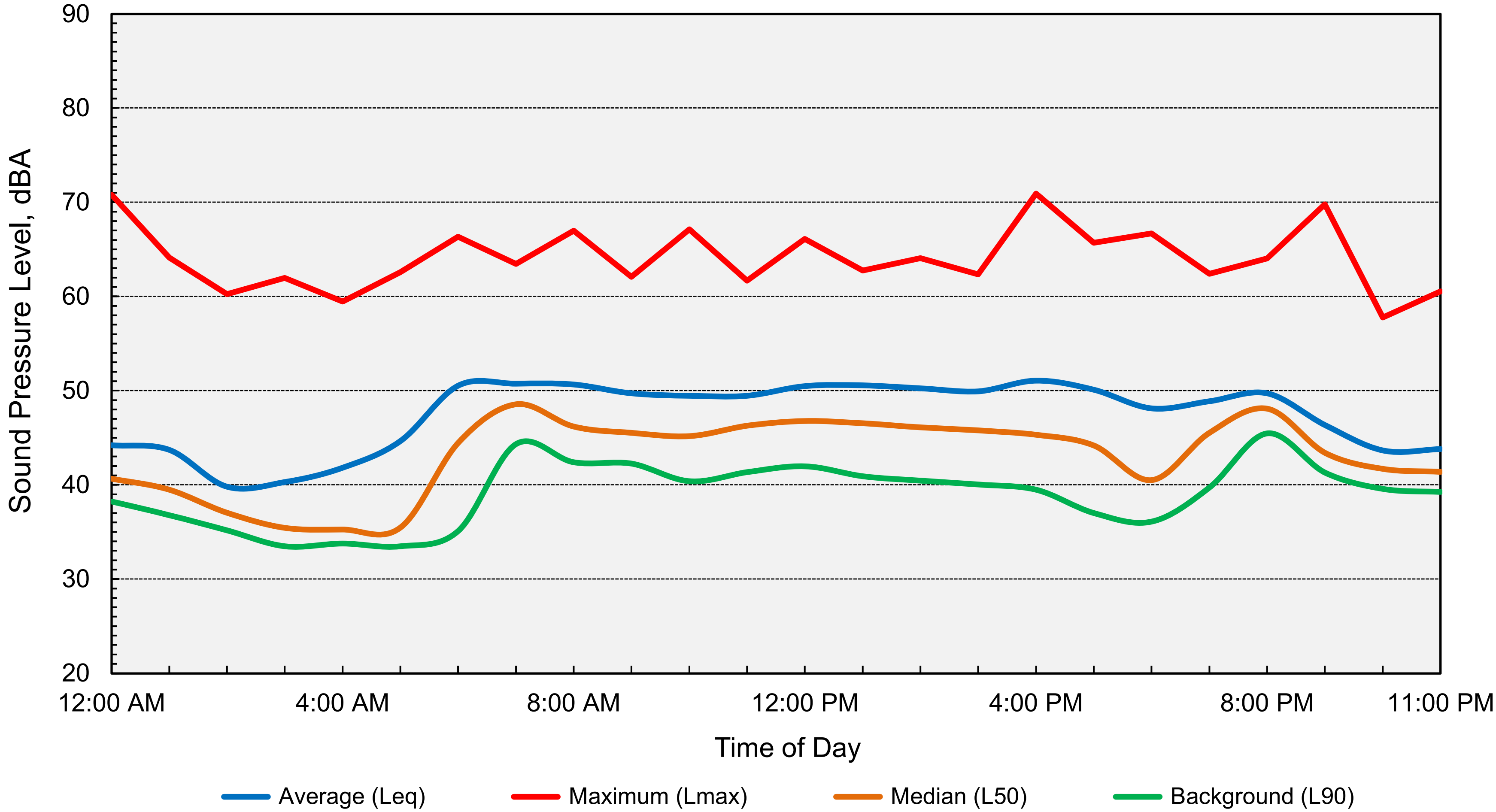
Appendix D-3
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 2
Wednesday, April 08, 2020



Computed Ldn = 52 dB

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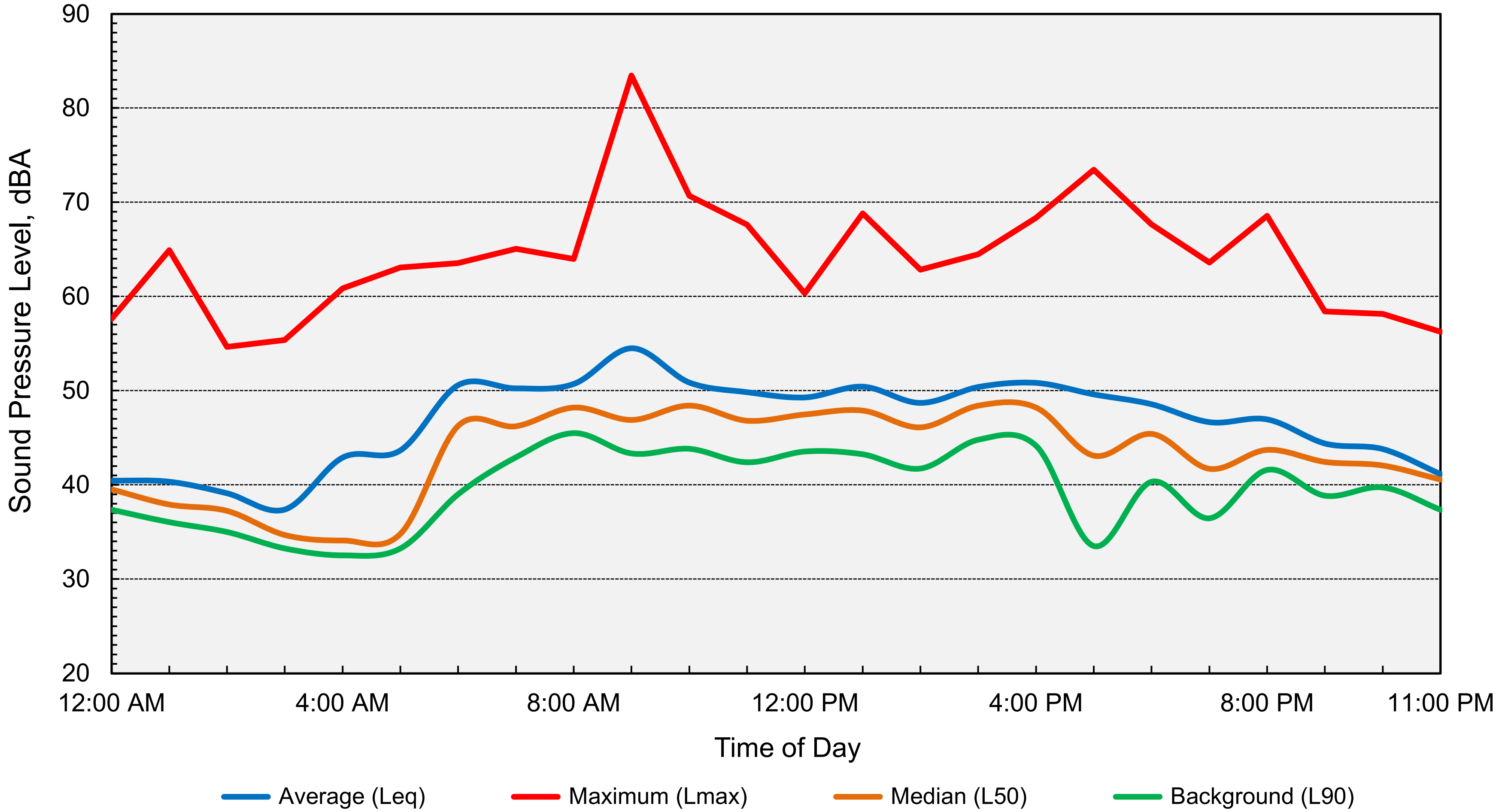
Appendix D-4
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 2
Thursday, April 09, 2020



Computed Ldn = 52 dB

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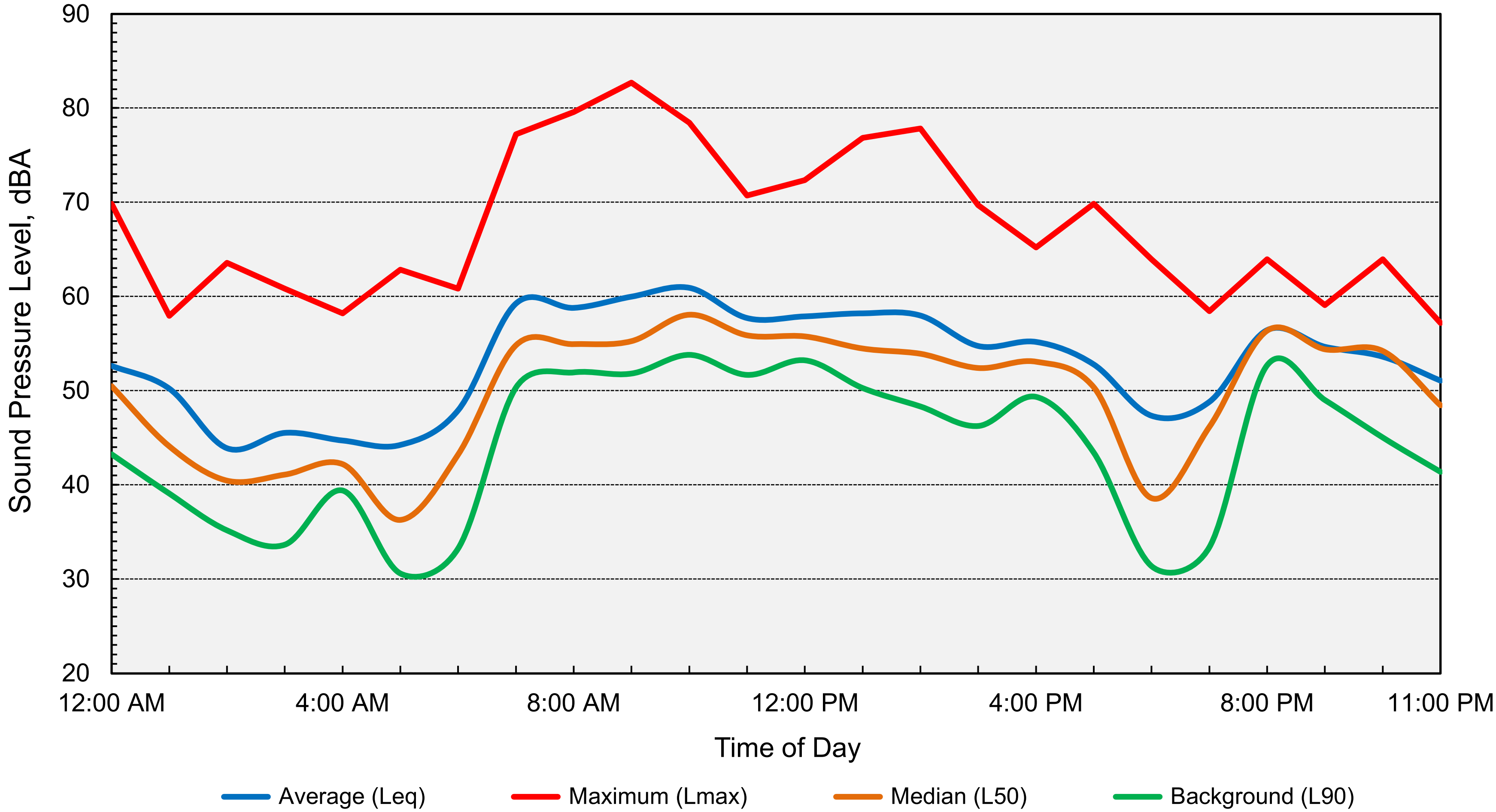
Appendix D-5
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 3
Wednesday, April 08, 2020



Computed Ldn = 58 dB

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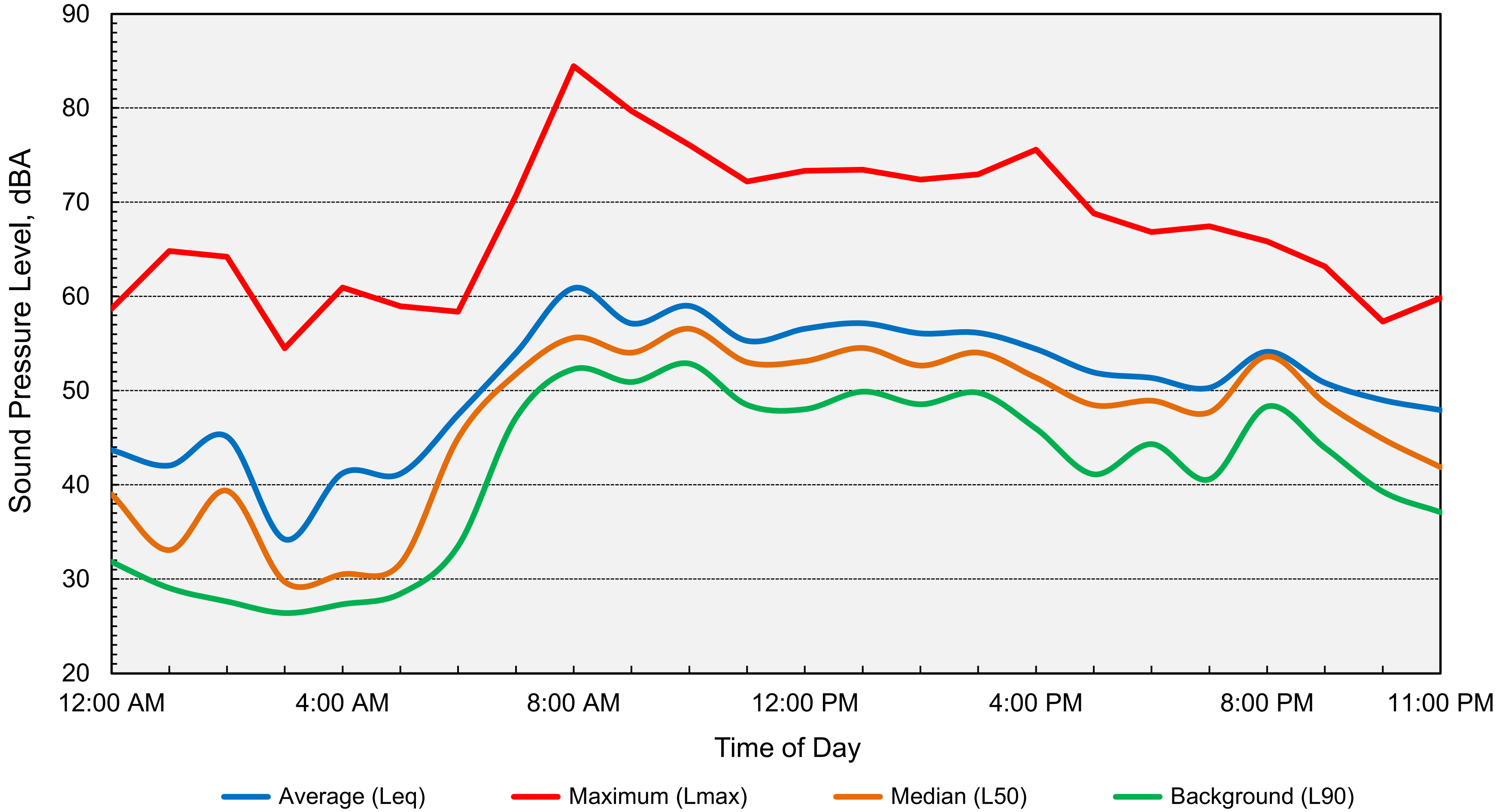
Appendix D-6
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 3
Thursday, April 09, 2020



Computed Ldn = 56 dB

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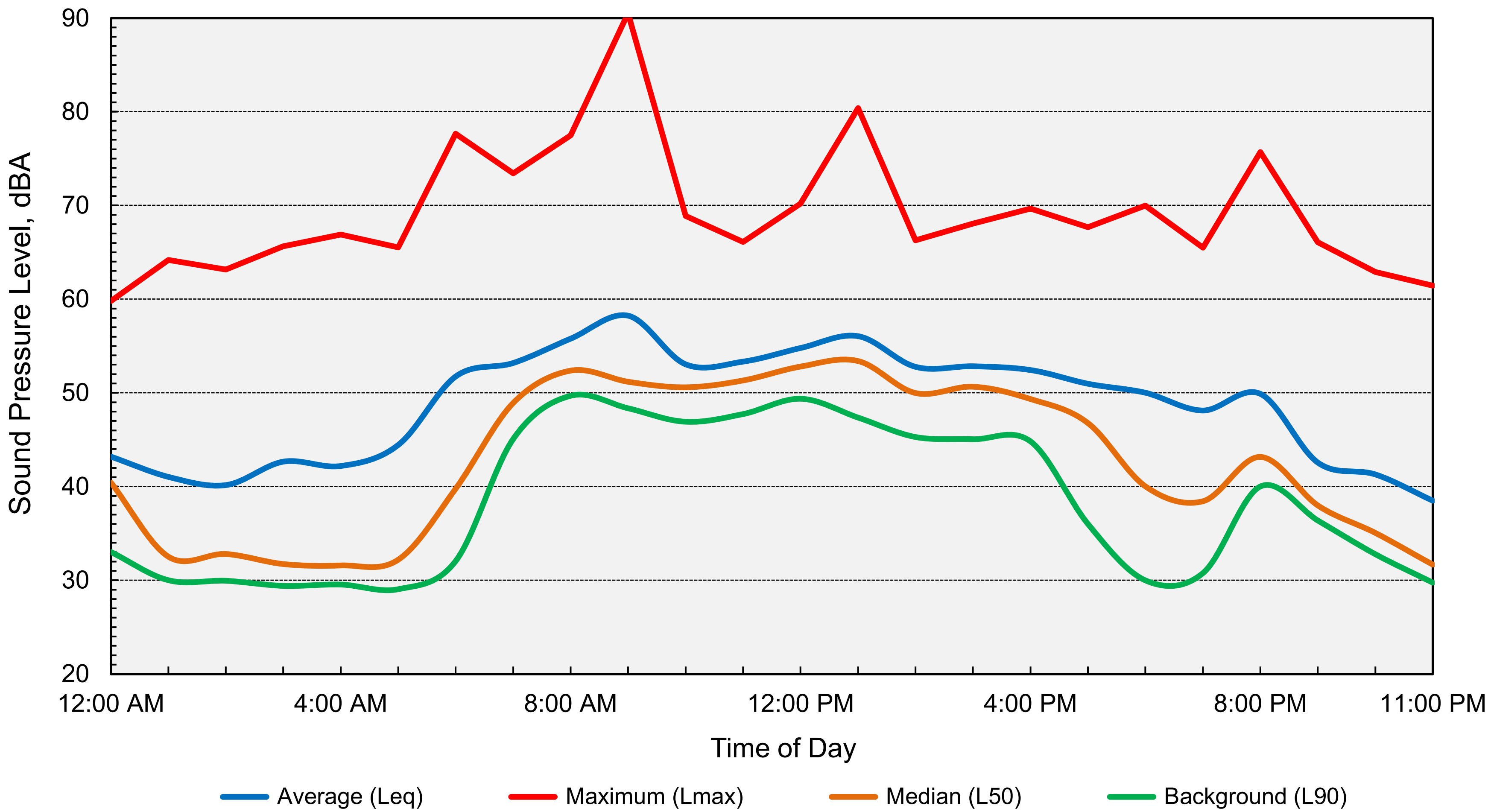
Appendix D-7
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 4
Wednesday, April 08, 2020



Computed Ldn = 54 dB

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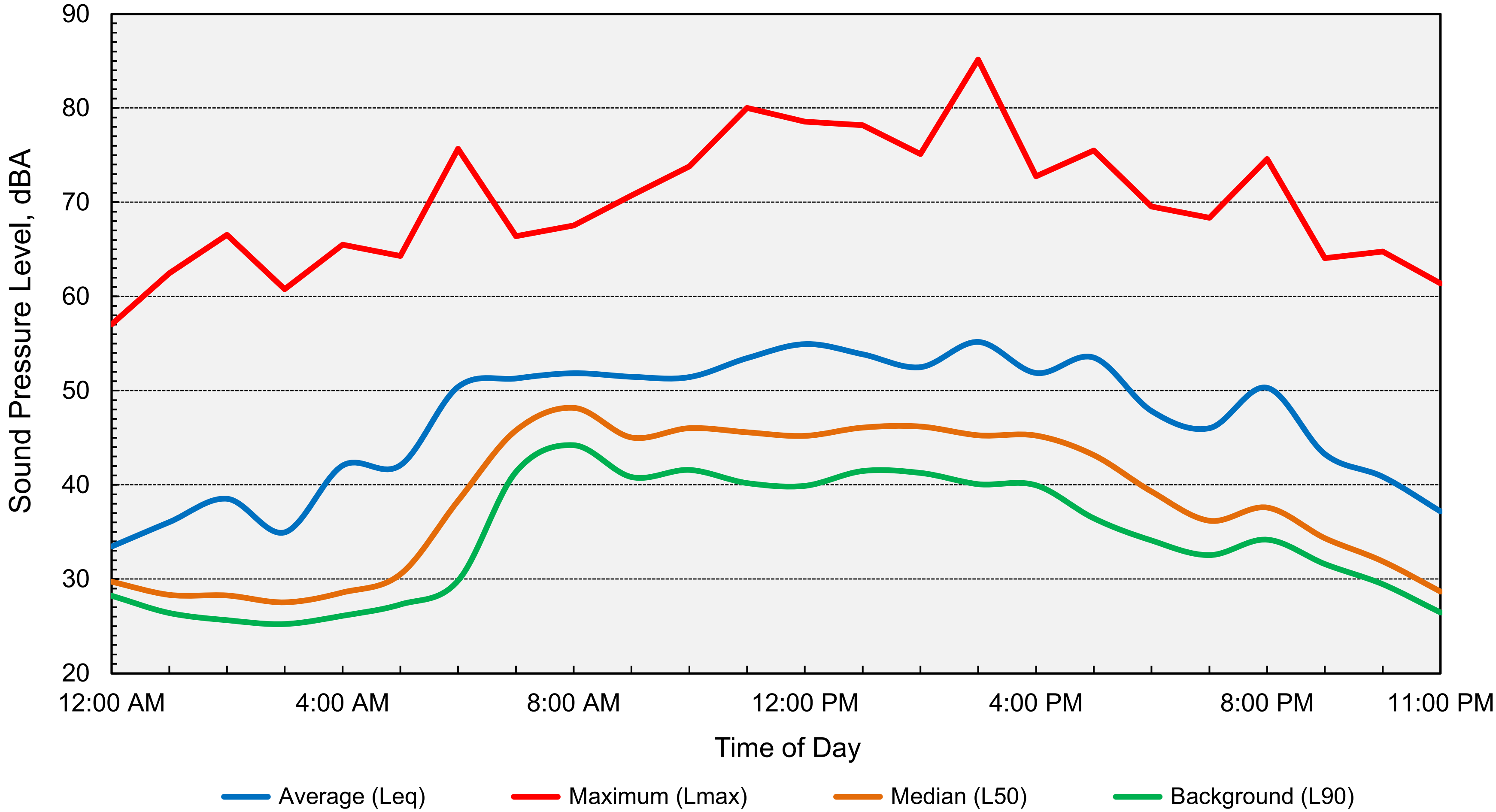
Appendix D-8
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 4
Thursday, April 09, 2020



Computed Ldn = 52 dB

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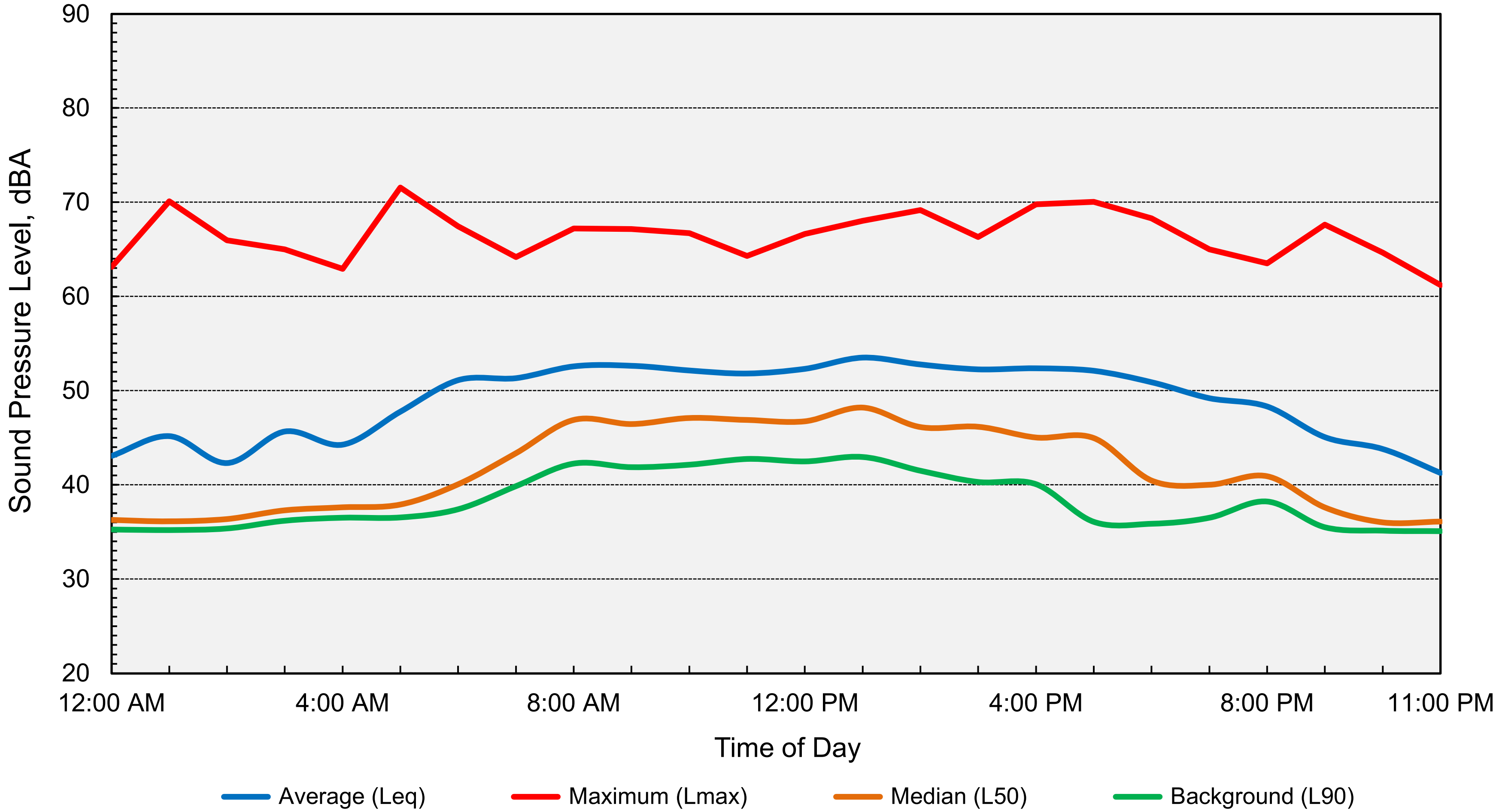
Appendix D-9
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 5
Wednesday, April 08, 2020



Computed Ldn = 54 dB

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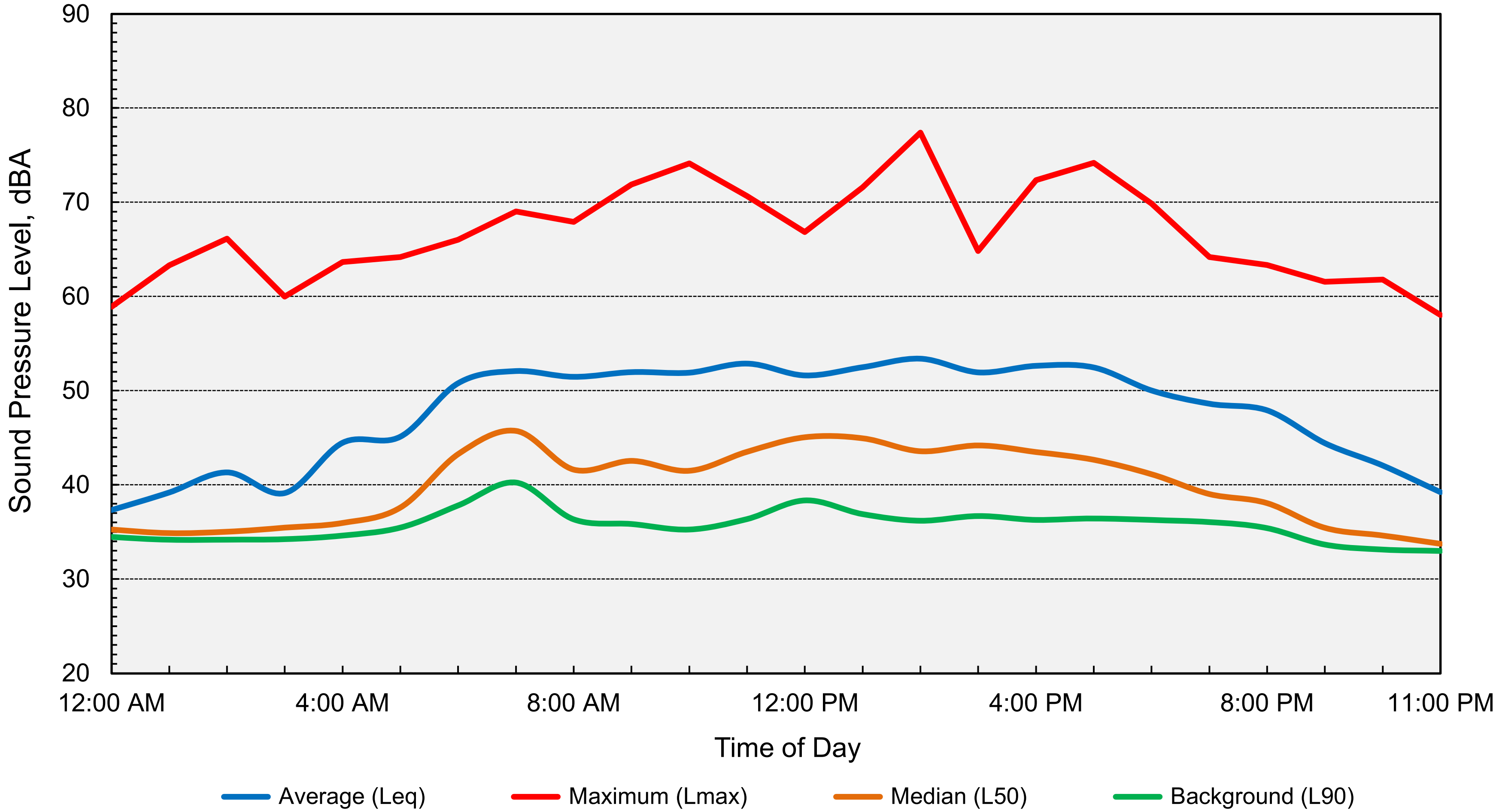
Appendix D-10
Ambient Noise Monitoring Results
Crystal Creek Aggregates Expansion Project - Site 5
Thursday, April 09, 2020



Computed Ldn = 53 dB

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Appendix E-1

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2022-093
Description: Existing - No Existing CCA Trucks
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance
1	Iron Mountain Rd	Highway 299 to Middle Creek Rd	1161	80		20	5	5	45	50
2	Iron Mountain Rd	Middle Creek Rd to CCA S Driveway	1196	80		20	5	5	45	190
3	Iron Mountain Rd	CCA S Driveway to Stubbs Ln	1196	80		20	5	5	45	270
4	Iron Mountain Rd	Stubbs Ln to Lumber Mfr Driveway	1191	80		20	5	5	45	410
5	Iron Mountain Rd	Lumber Mfr Driveway to Ball Mill Rd	1191	80		20	5	5	45	330
6	Iron Mountain Rd	Ball Mill Rd to Keswick Dam Rd	1110	80		20	2	2	45	125
7	Iron Mountain Rd	North of Keswick Dam Rd	665	80		20	2	2	45	30
8	Keswick Dam Rd	East of Iron Mountain Rd	1155	80		20	2	2	45	50
9	Highway SR 299	West of Iron Mountain Rd	5864	80		20	3	1	55	50
10	Highway SR 299	East of Iron Mountain Rd	5917	80		20	3	1	55	50

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Appendix E-2

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2022-093
Description: Existing CCA Trucks Only
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance
1	Iron Mountain Rd	Highway 299 to Middle Creek Rd	105	90		10	0	100	45	50
2	Iron Mountain Rd	Middle Creek Rd to CCA S Driveway	105	90		10	0	100	45	190
3	Iron Mountain Rd	CCA S Driveway to Stubbs Ln	105	90		10	0	100	45	270
4	Iron Mountain Rd	Stubbs Ln to Lumber Mfr Driveway	105	90		10	0	100	45	410
5	Iron Mountain Rd	Lumber Mfr Driveway to Ball Mill Rd	105	90		10	0	100	45	330
6	Iron Mountain Rd	Ball Mill Rd to Keswick Dam Rd	6	90		10	0	100	45	125
7	Iron Mountain Rd	North of Keswick Dam Rd	6	90		10	0	100	45	30
8	Keswick Dam Rd	East of Iron Mountain Rd	0	90		10	0	100	45	50
9	Highway SR 299	West of Iron Mountain Rd	11	90		10	0	100	55	50
10	Highway SR 299	East of Iron Mountain Rd	94	90		10	0	100	55	50

Appendix E-3

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2022-093
Description: Existing - All Total Traffic
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance
1	Iron Mountain Rd	Highway 299 to Middle Creek Rd	1265	80		20	5	5	45	50
2	Iron Mountain Rd	Middle Creek Rd to CCA S Driveway	1300	80		20	5	5	45	190
3	Iron Mountain Rd	CCA S Driveway to Stubbs Ln	1300	80		20	5	5	45	270
4	Iron Mountain Rd	Stubbs Ln to Lumber Mfr Driveway	1295	80		20	5	5	45	410
5	Iron Mountain Rd	Lumber Mfr Driveway to Ball Mill Rd	1295	80		20	5	5	45	330
6	Iron Mountain Rd	Ball Mill Rd to Keswick Dam Rd	1115	80		20	2	2	45	125
7	Iron Mountain Rd	North of Keswick Dam Rd	670	80		20	2	2	45	30
8	Keswick Dam Rd	East of Iron Mountain Rd	1155	80		20	2	2	45	50
9	Highway SR 299	West of Iron Mountain Rd	5875	80		20	3	1	55	50
10	Highway SR 299	East of Iron Mountain Rd	6010	80		20	3	1	55	50

Appendix E-4

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2022-093
Description: Project: Additional CCA Trucks Only
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance
1	Iron Mountain Rd	Highway 299 to Middle Creek Rd	105	90		10	0	100	45	50
2	Iron Mountain Rd	Middle Creek Rd to CCA S Driveway	105	90		10	0	100	45	190
3	Iron Mountain Rd	CCA S Driveway to Stubbs Ln	105	90		10	0	100	45	270
4	Iron Mountain Rd	Stubbs Ln to Lumber Mfr Driveway	105	90		10	0	100	45	410
5	Iron Mountain Rd	Lumber Mfr Driveway to Ball Mill Rd	105	90		10	0	100	45	330
6	Iron Mountain Rd	Ball Mill Rd to Keswick Dam Rd	6	90		10	0	100	45	125
7	Iron Mountain Rd	North of Keswick Dam Rd	6	90		10	0	100	45	30
8	Keswick Dam Rd	East of Iron Mountain Rd	0	90		20	0	100	45	50
9	Highway SR 299	West of Iron Mountain Rd	11	90		10	0	100	55	50
10	Highway SR 299	East of Iron Mountain Rd	94	90		10	0	100	55	50

Appendix F-1

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2022-093
Description: Existing - No Existing CCA Trucks
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Iron Mountain Rd	Highway 299 to Middle Creek Rd	57	53	57	61
2	Iron Mountain Rd	Middle Creek Rd to CCA S Driveway	49	44	49	52
3	Iron Mountain Rd	CCA S Driveway to Stubbs Ln	46	42	46	50
4	Iron Mountain Rd	Stubbs Ln to Lumber Mfr Driveway	43	39	44	47
5	Iron Mountain Rd	Lumber Mfr Driveway to Ball Mill Rd	45	41	45	49
6	Iron Mountain Rd	Ball Mill Rd to Keswick Dam Rd	51	43	47	53
7	Iron Mountain Rd	North of Keswick Dam Rd	58	50	54	60
8	Keswick Dam Rd	East of Iron Mountain Rd	57	49	53	59
9	Highway SR 299	West of Iron Mountain Rd	67	59	58	68
10	Highway SR 299	East of Iron Mountain Rd	67	59	58	68

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Appendix F-2

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2022-093
Description: Existing CCA Trucks Only
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Iron Mountain Rd	Highway 299 to Middle Creek Rd	21	14	58	58
2	Iron Mountain Rd	Middle Creek Rd to CCA S Driveway	13	5	49	49
3	Iron Mountain Rd	CCA S Driveway to Stubbs Ln	10	3	47	47
4	Iron Mountain Rd	Stubbs Ln to Lumber Mfr Driveway	8	0	44	44
5	Iron Mountain Rd	Lumber Mfr Driveway to Ball Mill Rd	9	1	46	46
6	Iron Mountain Rd	Ball Mill Rd to Keswick Dam Rd	3	-5	39	39
7	Iron Mountain Rd	North of Keswick Dam Rd	12	4	49	49
8	Keswick Dam Rd	East of Iron Mountain Rd	0	0	0	0
9	Highway SR 299	West of Iron Mountain Rd	14	5	49	49
10	Highway SR 299	East of Iron Mountain Rd	23	15	58	58

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Appendix F-3

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2022-093
Description: Existing - All Total Traffic
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Iron Mountain Rd	Highway 299 to Middle Creek Rd	57	53	58	61
2	Iron Mountain Rd	Middle Creek Rd to CCA S Driveway	49	45	49	53
3	Iron Mountain Rd	CCA S Driveway to Stubbs Ln	47	42	47	50
4	Iron Mountain Rd	Stubbs Ln to Lumber Mfr Driveway	44	40	44	48
5	Iron Mountain Rd	Lumber Mfr Driveway to Ball Mill Rd	45	41	45	49
6	Iron Mountain Rd	Ball Mill Rd to Keswick Dam Rd	51	43	47	53
7	Iron Mountain Rd	North of Keswick Dam Rd	58	50	54	60
8	Keswick Dam Rd	East of Iron Mountain Rd	57	49	53	59
9	Highway SR 299	West of Iron Mountain Rd	67	59	58	68
10	Highway SR 299	East of Iron Mountain Rd	67	59	58	68

Appendix F-4

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2022-093
Description: Project: Additional CCA Trucks Only
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Iron Mountain Rd	Highway 299 to Middle Creek Rd	21	14	58	58
2	Iron Mountain Rd	Middle Creek Rd to CCA S Driveway	13	5	49	49
3	Iron Mountain Rd	CCA S Driveway to Stubbs Ln	10	3	47	47
4	Iron Mountain Rd	Stubbs Ln to Lumber Mfr Driveway	8	0	44	44
5	Iron Mountain Rd	Lumber Mfr Driveway to Ball Mill Rd	9	1	46	46
6	Iron Mountain Rd	Ball Mill Rd to Keswick Dam Rd	3	-5	39	39
7	Iron Mountain Rd	North of Keswick Dam Rd	12	4	49	49
8	Keswick Dam Rd	East of Iron Mountain Rd	0	0	0	0
9	Highway SR 299	West of Iron Mountain Rd	14	5	49	49
10	Highway SR 299	East of Iron Mountain Rd	23	15	58	58